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Variable Speed Motors.

The electrical driving of machine tools has now become a settled part of modern practice. The plan has been somewhat slow of adoption, but the changes of the past few years have hastened its acceptance. Granted the correctness of modern principles of machine tool working, and the use of variable speed motors follows almost as a necessary consequence. The underlying thought in the machine shop is the forcing of output so as to obtain the maximum of profitable work with the minimum of labor and general expense. The latter factor of cost in particular is susceptible of rapid reduction through increase of output, with which it increases much less rapidly than does labor. Hence the importance of pushing the machine tools to their utmost capacity consistent with the turning out of good work. And experience has now shown that by driving a big machine tool electrically, its output can be kept nearer to a maximum than by working from a line shaft in the old-fashioned way. Part of the gain is genuinely physical, part of it is moral. There is no doubt as a mere matter of mechanics that, with cone pulleys and a sufficient amount of back gearing, a machine can be given all the range of speed that can properly be required of it. But as a matter of human nature, the workman cannot be brought to following up the requirements of the cut by adjustments that require stopping to consider the situation and making a series of adjustments. Give him a rheostat handle within reach of his hand and he will soon learn to shift his speed in accordance with his requirements, with the result of not only pushing through more work but better work. For, as every mechanic knows, quite apart from output, various kinds of work require various speeds to secure the cleanest results.

All this is as a matter of principle pretty well known at the present time, and yet there is often considerable hesitancy in going to the expense of fitting up a shop for electrical driving. Aside from natural conservatism, there is in many cases a feeling that from the particular nature of the work in hand, the game is hardly worth the candle. There are many machines, indeed, in which electric driving is from the standpoint of output a secondary consideration. It may be and often is desirable by reason of economy in power, but there are numerous machines, particularly of automatic or semi-automatic character, in which the output is uniform and regular, and which consequently can be set once for all at the best working speed and kept there. In the same shop there may be other machines in which variable speed is of the utmost consequence, and which should be electrically driven, although a wholesale change of motive power seems hardly worth the while. These are the cases which deserve special attention, for there is some misapprehension existing as to the difficulties of installing a partial electric drive. Much industrial motor work has been done on the basis of installing a special shop plant, sometimes with rather complicated wiring to secure a multiplicity of voltages. In cases where the speeds of many machines may vary over wide ranges, this is an almost necessary procedure. In engineering works, for example, where the work is in large measure special and large tools have to be used for a great variety of purposes, a special plant is the best solution of the problem. In many shops, however, there are few large tools for general use and many specialized tools steadily working on uniform output. In such cases the obvious thing is to put electric drive on the tools where it is most important, and leave the rest, temporarily at least, running on the old basis. Or perhaps in adopting electric driving most of the machines could be driven in groups by constant speed motors while the variable speed motors could be put on the individual machines that most required them.

The point of the matter is that electrical driving is a thing wonderfully flexible which can be used to meet exigencies without committing one to a general change of policy in a whole shop. There are now upon the market motors specially designed to secure variable speed by modifying the field strength, the voltage remaining constant. Of course, it is to be understood that such machines are somewhat more massive than constant speed motors, but they actually do give a wide range of speed with good efficiency, and aided by a single change in the back gearing, are fully able to meet all ordinary requirements. Indeed, with a speed in itself variable in a ratio of 1 to 4 or 5, most applications may be made without any mechanical speed changing. Now in this way it is a very simple matter to give a complete control of speed in large and intermittently used tools without the installation of a shop plant if good public supply is at hand, or by a plant of simple character and moderate size run from the shop engines. One can thus "try it on a dog," as it were, without undertaking any general change in motive power, and can run electrically merely those machines in which variable speed is of most importance. The next step which will probably suggest itself is the electrical driving of those machines or groups of machines which from their situation absorb undue power in belts and shafts. Such uneconomical machines are frequently the automatic tools doing rapidly rather light work. The saving in power by cutting loose from complicated line shafting is generally enough to make electric driving worth the while, and thus gradually a shop can work over toward a complete electric equipment, starting from the simple requirement of variable speed under the most sensitive control for a few special tools. Enough experience has now accumulated to enable one to say definitely that variable speed motors applied to heavy machine tools really do improve the output in quality and amount by keeping the machine always working at the best point. In that large work which requires portable tools, too, the gain from motor driving is at once apparent. But many shops have been frightened away from such improvements by the serious expense involved in a complete change. In the present state of things this wholesale change is quite needless, and it is practicable to give the electric drive a try under the most favorable conditions.

A Comparison in Bridge Construction.

The general characteristics of modern iron and steel bridge design and construction in this country, and the advances made in that field of engineering work, have many times been the subject of editorial comment in The Engineering Record, but it is not fruitless to make an occasional comparison between bridge work done in this country and that accomplished in other countries where different standards of procedure are found. The well-known peculiarly American characteristics of bridgework are long panels, relatively high trusses, especially where the bending moments are greatest, simplicity and concentration at joints, and few superfluous members, all of which contribute to apparent lightness and actual openness of structural effects without in any way trenching upon abundant margin of security for the heaviest loads. These observations are applicable especially to pin-connected bridges, although they are also applicable to bridges with riveted connections. In Europe, on the contrary, opposite features of design are usually, if not universally, found. In both Continental and British bridges, those features which first strike the eye and carry a corresponding impression to the mind, are a heaviness of individual members, short panels and relatively small depths, producing the effect of great weight of structure and closeness of articulation. These effects are enhanced by the prevalence of riveted connections and their necessarily extended dimensions. Pin-connections are rarely found and the absence of open and graceful effects is prominent. These features are not necessarily the subject of unfavorable criticism, but they do usually militate against economy and rapidity of construction and prevent the ready and effective meeting of many exigencies of construction arising in this country, probably more frequently than abroad, in consequence of the many large rivers and our enormously extended railroad development. The comparison of these features of foreign and American bridge construction is admirably illustrated by two papers published in the "Proceedings" of the American Society of Civil Engineers for March. One of these papers is by H. C. V. Moeller, chief engineer of the Port of Copenhagen, on the construction of a new swing bridge designed to cross a part of the harbor of Copenhagen, and the other, by J. E. Greiner, M. Am. Soc. C. E., on the reconstruction of the Baltimore & Ohio R. R. bridge over the Ohio River at Benwood, W. Va.

The Copenhagen draw span is less than 210 ft. long, and of the pony type, except that it has overhead bracing and an operating house over the roadway at the centre pier, the structure being a roadway bridge. The end depth of the trusses is about 9 ft. and about 27 ft. at the centre. Although the length of each arm is not far from 105 ft., the panel length is but about 9 ft., and as riveted connections are found throughout, the impression produced by the plan is that of a superfluously large number of members, and of an unnecessarily great weight of structure. The comparatively small depth of truss also conveys the impression of excessive deflection, although the weight of metal in the trusses probably gives them at least ample stiffness. It is a solid and substantial structure, but with an outline and disposition of members lacking grace and other elements of beauty which ought to characterize a city bridge. Greater depth of truss and longer panels would have conduced to much more agreeable results as well as to greater economy and increased stiffness.

That, however, which most impresses an American engineer with unnecessary bulkiness and almost mal-adaptation to its purpose, is the turning machinery. When the bridge is to be opened, the whole movable part, weighing about 850 tons, is lifted about 6 in. in fifteen seconds by hydraulic power. As thus raised, the superstructure rests on a pivot supported in a mixture of half glycerine and half water, a pressure of 52.5 atmospheres being employed. This actuating machinery, with its accumulators, pumps, valves, pipes and tank, occupies the greater portion of one-half of the centre pier of oval shape 30.9 ft. wide and 63.9 ft. long. When it is reflected that the turning machinery of the largest American draw spans is usually housed either within the drum of the turntable, or in a small engine room in the overhead bracing over the centre pier, the bulky character of the operating machinery of the Copenhagen draw span and the costly character of the provision made for it can readily be realized, especially as the draw is a short one, i. e., but little over 200 ft. long.

The reconstruction of the Benwood bridge involved nothing unusual in American bridge construction except the erection of one 345-ft. span without falsework. Two spans only of this bridge were reconstructed at this time, one about 345 ft. and one about 240 ft. long. The old spans were built in the early days of iron bridge construction in this country, with panels about 15 and 13 ft. long respectively. The new spans were designed with panels double that length. The centre depths of the trusses were each about fifty per cent. greater than the old. The new spans were of course designed for much heavier loads than the old. The depth of truss in the new spans is least at the ends and greatest at the centre, according to the usual modern plan. The result is great gain in economy and an openness and gracefulness of structure entirely absent in the old trusses which were of uniform depth.

These were not all the advantages of the new design. As already stated, it was essential that the 345-ft. span should be erected without falsework. The long panels and resulting few members, together with the pin-connections adopted, enabled this erection to be done with the maximum of convenience and in the shortest possible time. Each span flanking the 345-ft. span was temporarily connected with it along the upper chord lines so as to make each uncompleted portion of that span a cantilever bracket of increasing length until connection was made at the centre of the span. After the erection of the trusses was thus completed the temporary connections with adjoining spans were removed, leaving each truss simply supported at each end.

This is a marked instance of the adaptability of American structural design to serious exigencies that may occur. It is not the least of the excellent results which have been reached in American bridge practice that the system of design and the character of the trusses lead not only to economy and efficiency under the ordinary conditions of construction, but enable the extraordinary conditions to be met with the minimum of expense and the maximum of convenience.

Leakage in the Torresdale Conduit at Philadelphia.

The amount of leakage in the Torresdale conduit of the Philadelphia water-works is an interesting engineering subject, not because the newspapers of that city have been shocked out of their customary Quaker calm by the slight percolation of ground water into this aqueduct, but because the data on the subject of such leakage are very few. Accordingly, this work has afforded information of much value, for the water entering it during various stages of its construction has been gauged with sufficient accuracy for all practical purposes. The conduit was described in detail in this journal on May 18, 1901, and February 27, 1904. It is 13,809 ft. in length between the two end shafts, about 100 ft. below the ground level, and 10 ft. 7 in. in diameter. The invert is of two courses of brick on a cradle of cement, and the arch has three to five courses of brick, depending on the material of the roof. The space between the brick and roof was packed with concrete, if this could be done, otherwise it was grouted. It seems probable that the head on the interior of the conduit will be about 10 ft. greater than the ground water head when the conditions are normal.

The specifications called for a water-tight conduit. By this was meant a conduit reasonably water-tight, in the same sense that a cast-iron water main is required to be tight. The word was not used in an absolute sense, signifying entire freedom from leakage and percolation, but was intended to call for a conduit as impervious as the materials employed would permit. No engineer would expect a conduit built like this to be impervious, yet the actual amount of the leakage, as stated by Mr. John W. Hill in a paper before the Engineers' Club of Philadelphia, is so small as to be noteworthy. This is particularly so when some of the troubles experienced in construction are borne in mind. About nine-tenths of the tunnel was in hornblendic and biotite gneiss, requiring no timbering, but containing in one place a large amount of water. At some places the rock was micaceous and so rotten as to require heavy, close timbering. The amount of water encountered was much greater than anticipated.

Unusual precautions were taken to obtain good brick for the lining, and a large quantity was rejected; in fact, it was necessary to allow the use of two sizes in order to insure prompt deliveries. It was originally proposed to cover the interior of the brick lining with a half-inch coat of Portland cement plaster, and 21 per cent. of the work was done when it became evident that the plaster could not be made to adhere. Along more than half the tunnel, enough water was encountered in the rock to make it almost impossible to insure proper setting of the mortar joints without taking special precautions. The remedy employed was to place two layers of tar paper over the arch from springing line to springing line. Experience showed that this could be relied upon to exclude the water for many days, during which time e mortar in the brickwork had ample opportunity o harden.

The actual leakage into the conduit when only a portion of the brick lining and concrete backing was in place was about 2,175 gal. per minu This amount was the flow from the rock as it was left after tunneling. When the work was completed and before it was put in service, the leakage seemed very great, and the conduit was pumped out. It was found that two large sumps had not been closed and that there were a number of large open joints in the brickwork. The defects were repaired, and gaugings of the inflo were made, showing a leakage of about 900 g per minute. This amount is so small that it negligible, and indicates a satisfactory conditi of the conduit which ought to be gratifying those responsible for this great work. It shou be borne in mind that this leakage was measur with an empty conduit, under hydrostatic cond tions much more severe than any likely to occ when the aqueduct is in use.

The Reorganization of the Isthmian Cana Commission.

The President and Secretary of War have r organized the Isthmian Canal Commission, an its former members, with the exception of Majo Harrod, are no longer connected with it. Unde the law governing the construction of the cana the President is made responsible for the successful prosecution of the work; the members of th Commission are his personal appointees, not approved by the Senate, and he is responsible fo their acts in the same degree that he is responsibl for the work of the various executive department The members of the Commission who resigned few days ago were all men of the highest standing, but for certain reasons which it is needles and useless to discuss at this late day, they di not, as a body, give to the President and the Secretary of War the prompt and full informatio concerning the progress of their work which th law evidently contemplated. In the reorganizatio of the Commission, there has been a very positiv insistence on the obligations of the body towar the President, and this would be still more evident had the law governing the Commission no made it necessary for him to appoint seven members. As a matter of fact only three of the members occupy positions which are of much more than nominal responsibility, and the real work o the body is to be done by three men, forming an executive committee of the Commission, and a Board of Advisory Engineers.

In its general plan, leaving out of consideration the members appointed to the Commission to satisfy the law or for minor duties, the new organization is well adapted for prompt and economic administration of affairs. The work is to be done under three departments, all with their headquarters on the Isthmus. The first is the executive department, of which the chairman is head. It will have charge of the fiscal affairs of the Commission, the purchase and delivery of all materials and supplies, the accounts, bookkeeping and audits, the commercial operations in the United States of the Panama railroad and steamship lines, and the general concerns of the Commission, subject to the supervision and direction of the Secretary of War. The head of the second department is the governor of the Canal Zone; he is made responsible for the administration and enforcement of the laws in the Zone, and for all sanitary matters in that district, including supplies and construction for sanitary purposes. The head of the third department is the chief engineer. He is responsible for the actual work of construction carried on by the Commission on the Isthmus, for the custody of all supplies and plant on the

Isthmus, and for the operation of the Panama R. R. These three heads of departments are all members of the Commission, and in their united capacity of executive committee practically form the whole active organization. The chairman, Mr. T. P. Shonts, is a graduate of the college of which the father of Chief Engineer Wallace was long the honored president; he is a railroad executive of high standing, and has the reputation of being an economical administrator as well as a good driver of work. Judge Charles E. Magoon, governor of the Canal Zone, has been associated with the Commission as counsel for some time, and is thoroughly in touch with all the work which will fall to his department. Mr. John F. Wallace, chief engineer, needs no introduction to the readers of this journal, who will all be gratified to learn of his promotion to membership in the Commission. These three officers will all receive the free use of furnished residences on the Isthmus, where they are expected to reside and where they are to hold official meetings twice a week. The remaining officers of the Commission are engineers previously connected with canal work, Rear Admiral M. T. Endicott, Brig.-Gen. Peter C. Hains, Col. Oswald H. Ernst, and Major B. M. Harrod. A branch office will be maintained in Washington, to enable the President and Secretary of War to keep in close touch with all affairs of the Commission.

The new feature of the organization is the Board of Consulting Engineers, probably of nine members, to whom will be submitted by the Commission for its consideration and advice the important engineering questions arising in the selection of the best plan for the construction of the canal. Its recommendations "shall be considered by the Isthmian Canal Commission, and, with the recommendations of the Commission, shall finally be submitted through the Secretary of War to the President for his decision." It is announced that Messrs. Wm. Barclay Parsons and Wm. H. Burr, recently members of the Commission, will be appointed on this Board. Although it is not absolutely certain yet that an attempt will be made to have this organization an international one, this seems likely to be the case, and is the one feature of the proposed plan which is most open to criticism. If the President were fully informed concerning the records of international engineering boards, he would know that they are pretty unsatisfactory. The different methods of handling work with which engineers of various countries are most familiar render the opinions of an international board on methods of construction of very little value. In the case of the Panama canal the whole problem depends in a very large degree on a familiarity with American methods of handling earth and rock excavation, which are better for this undertaking than any other system. To bring into consultation on this work European engineers who are unacquainted with our methods is to introduce a serious chance of discord in a part of the work where prompt and definite decision is particularly desirable. There are, of course, some engineers, of whom Sir Benjamin Baker is an example, who have a cosmopolitan engineering instinct and would be admirable members of any board of civil engineers, yet it is to be hoped that the President will reconsider the plan, if he really holds it, of making the Consulting Board an international one. It would be difficult to picture an organization more likely to furnish nothing but trouble than one on which the engineers of various leading ship canals had places, yet this seems at the present moment to be contemplated.

It will be noticed that this new organization is very different from that of the Commission up to this time. In place of a body meeting in Washington it practically substitutes the Secretary of War, and leaves all executive detailed administration in the hands of three men resident on the Isthmus.

Notes and Comments.

A COMPREHENSIVE IRRIGATION CODE has been adopted by the North Dakota legislature, following the suggestions of Mr. Morris Bien, of the U. S. Reclamation Service. This is the first effective legislation on the subject in the State and is expected to put irrigation investigations on a well-established basis.

A SPECIAL WATER-WORKS ACT was passed in the Montana legislature recently, authorizing cities and towns to form special improvement districts for the purpose of defraying the cost of constructing or acquiring water systems. The law also provides for assessing the cost of mains on abutting property, the amount to be paid in special taxes during three to ten years; the amount raised in this way is not to exceed $1.50 per foot of main, and all extra expense must be borne by the general water fund. The purpose of the act is apparently to enable cities and towns to exceed the legal limit of indebtedness in order to obtain water works.

A LARGE LIFT LOCK will be built at Kirkfield on the Trent Canal in Canada by the Dominion Bridge Co. Its height of lift will be 48.5 ft. The chambers will be 140 ft. long, 33 ft. wide, and have 8 ft. of water over the gate sills. The main cylinders will be cast steel. The main rams will be 7.5 ft. in diameter and 57 ft. long. The total weight on each ram will be about 1,700 tons, and the working pressure in the main cylinders will be about 600 lb. The towers will be of structural steel, and about 100 ft. high, and the upper approach will be a steel aqueduct about 35 ft. long. This use of steel instead of concrete will render the lock considerably different in appearance from the similar lock on this canal at Trent.

AN AIR-COOLING AND HUMIDITY-REGULATING PLANT, the largest of its class ever installed, is a feature of the mechanical equipment of the New York Stock Exchange Building, a description of which begins in this issue. An analysis of the calculations on which the proportions of the heating, ventilating and refrigerating apparatus are based will be outlined in these articles. It has been impracticable in such a series to give a detailed description of all the conditions, the problems or the scope of this unusually successful engineering work. Even in making the engravings, it was found necessary to omit many details, such as the air ducts and most of the piping in the cellar plan, in order to secure legible illustrations, and very few photographs of the completed installation could be taken on account of the thorough utilization of the space. A personal inspection of the plant is really needed to afford a correct appreciation of its magnitude, the creditable achievement in the consulting engineer's design and the care that was evidently exercised by him and the contractor in running the various classes of pipes and numerous large air ducts.

CLEANING BITULITHIC PAVEMENT in New Bedford has been investigated carefully by Mr. C. F. Lawton, superintendent of the Street Department, whose conclusions are as follows: During dry weather there is no difficulty in keeping it clean by hand sweeping, but after a day or two of wet weather the surface becomes coated with a slimy substance, which can only be removed by flushing. The use of fire hose for this purpose is expensive and liable to frighten horses. It has at last been found that the work can be done with an ordinary vertical spray-sprinkling cart, such as that made by the Eastman Co., of Concord, N. H. By starting on the crown of the street and opening the valves to their widest extent, a few trips along the street washes all the filth to the gutter. The water from the passing cart does not strike any one point long enough to disintegrate the surface.

HYDRANT INSPECTION in Rochester, N. Y., last winter was very successful. In the most important section of the city, where there are 420 hydrants, they were examined three times a week. The 2,700 hydrants in other sections were examined twice a week in severe weather and at other times as often as seemed necessary. There were 99 hydrants frozen during the winter which had to be thawed with steam, some of them on two and three occasions. In addition there were 117 hydrants which were frost-bitten and had to be thawed with hot water. There were 14 hydrants in exposed places which were examined once or twice every day. The result of this inspection has been the entire absence of complaint by the Fire Department regarding the hydrants.

WATER WASTE IN BUFFALO has been investigated recently with interesting results. In one section a flow of 40 cu. ft. a minute in the supply main was registered at midnight. The buildings were inspected and notices served to repair 160 services, 255 closets and 182 faucets. Three weeks later another midnight reading showed that the main was running only 10 cu. ft. In a second section of the city, a midnight reading showed 42.5 cu. ft. running every minute. After an inspection of the houses in this district, notices were served to repair 125 services, 275 closets and 204 faucets. A month later another midnight reading showed that but 7.5 cu. ft. per minute was flowing in the main. These figures show very conclusively how valuable a pretty complete installation of meters would be in Buffalo.

A VAGRANT ROAD ROLLER, which did considerable damage, recently caused a unique decision in the California Supreme Court. This roller, it seems, left its allotted path on an Oakland street, broke up a cement sidewalk, demolished a fence, destroyed a lawn and shrubbery, and ended by butting a house so vigorously that it was displaced on its foundations and permanently injured. It is not surprising to learn from 78 Pac. Rep. 1045, that the court has decided as follows: "Evidence that defendant's steam roller, used on the street in front of plaintiff's residence, was run over their fence and lawn and against their house, is sufficient to sustain a finding by the jury that the injury was occasioned by the negligence of the defendant." This detour of the roller accordingly cost its owners $1,000 and legal expenses.

A BRICK-FACED DAM is being constructed from the plans of Mr. R. H. Wyrill for the water supply of Swansea. The maximum height above the foundation will be about 130 ft. The inner face is vertical for its upper 70 ft., and then batters 1:20. The outer face is slightly concave, and the thickness of the dam at the level of the river bed, 30 ft. above the foundation, is about 75 ft. The structure is of cyclopean masonry, the Portland cement concrete used in the hearting being mixed 1:2:5, and that in the lower part of the base and the outer 6 ft. on the inner face 1:2:3.4. As it was very difficult to dress the local stone, it was decided to face the structure with blue Staffordshire brick in 1:3 Portland cement mortar. In the exposed facing on both sides of the dam, the best quality of facing bricks was used, while behind them the best quality of brindle brick was employed. This use of brickwork has aroused considerable discussion, and was not adopted until experiments lasting some time had been made. A brick-faced spillway in a small dam at Worcester, Mass., was described in this journal several years ago.

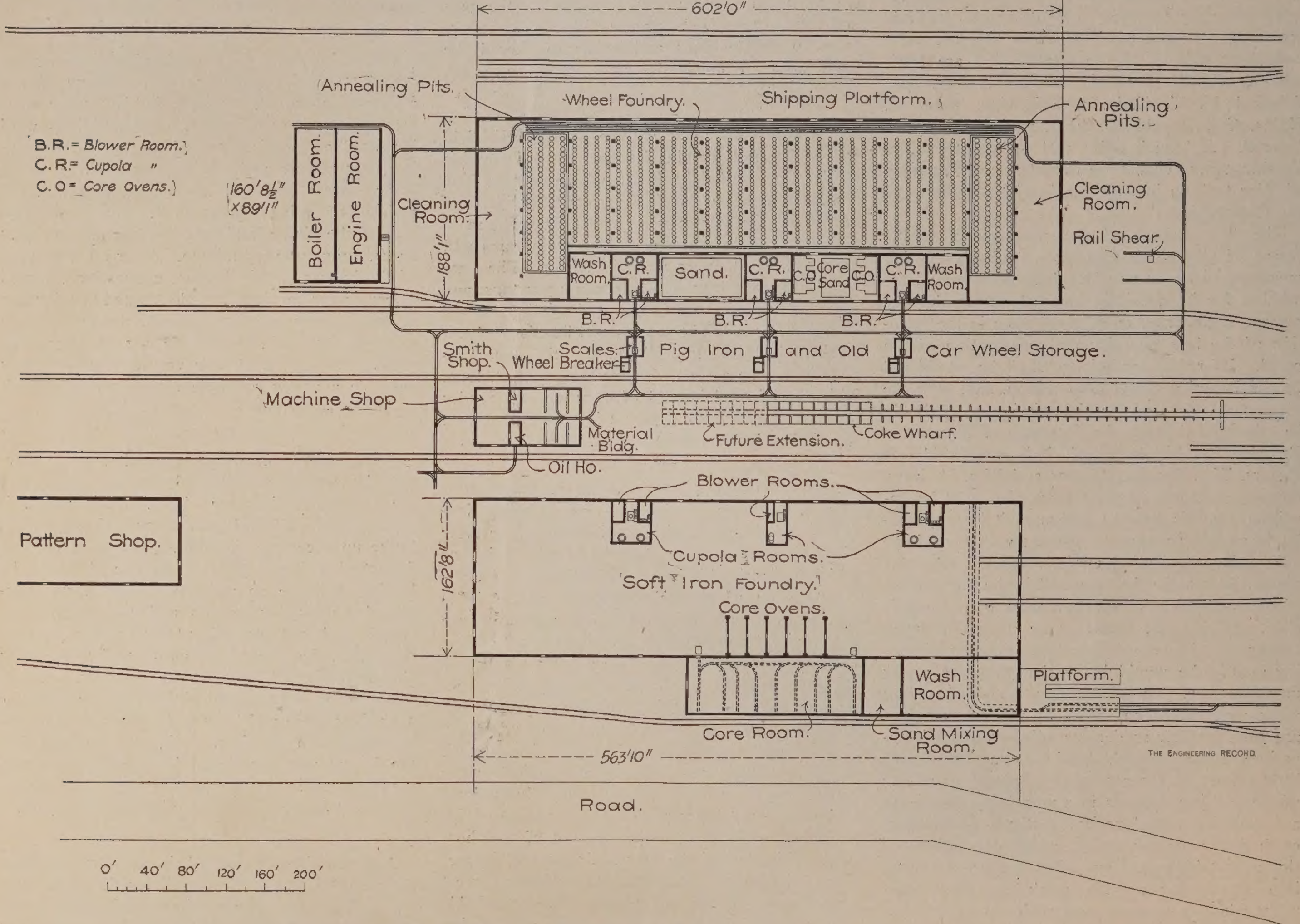
THE NEW CAR-WHEEL FOUNDRY OF THE PENNSYLVANIA R. R

The Latest Addition to the Great Railway Shops at Altoona, Pa.

The city of Altoona, Pa., has for many years been notable as the seat of the Pennsylvania Railroad's great plant for the construction and repairs of locomotives and other rolling stock. This embraces a number of large shops with separate organizations under one management, and includes foundries for car wheels and miscellaneous castings. Connected with the latter are pattern making and storage buildings, which inevitably involve considerable fire risks, and when their rebuilding and extension was recently determined it was thought desirable to isolate them as much as possible from the rest of the plant. The work is of such magnitude and importance as to demand separate management, the product is independent of that from the other shops, and as the foundry specialist requires experience and has duties differing widely from those of the managers of the other shops, it was decided to make this part of the works a separate plant. It has therefore been located in South Altoona, about 3 miles from the main office and works, on a short branch railroad connecting two main lines where freight facilities are ample, and there is abundant room for extension and for workmen's houses. Here the wheel foundry and the soft iron foundry, using, to a large extent, the same supplies of coke, pig iron and sand, have been located side by side, with a common power plant and pattern building. They are arranged, and their track service is so planned, that the group may hereafter be extended if desirable by the addition of brass and steel foundries.

The site includes about 85 acres of meadow land. The surface sloped quite uniformly, and a section about 840 ft. wide and 2,000 ft. long has been graded by steam shovels, which have excavated about 175,000 cu. yd. of earth and clay from the high side and filled in on the low side, leaving the surface about 1 ft. below grade, which will be covered with shale, gravel and cinders to make a dry surface and provide ballast for the railroad tracks. Ample water supply is received from the city mains under a pressure of about 70 lb., and an independent gravity sewer system has been built.

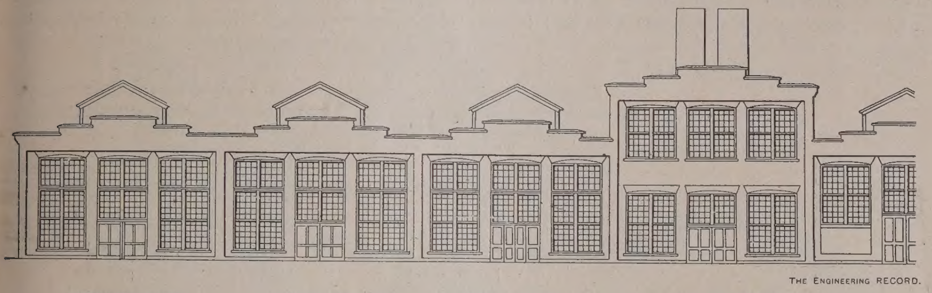
A 60x40-ft. two-story office, and all of the buildings shown on the general plan, have been erected, and about two-thirds of the plant has been installed in the wheel foundry, making two complete sections, which are now in operation, with an output of about one-half that of the entire plant. The soft iron foundry and pattern buildings are not yet finished, and none of the machinery is installed in them, but it is expected to have them ready for use in July. All of the main buildings are of red brick, one story high, with steel roof trusses and large window spaces in the side walls and ventilating monitors above the double-pitched roof trusses. Materials and products are handled to and from the plant on several longitudinal lines of standard gauge tracks, and are distributed through the yard and buildings on narrow-gauge surface tracks. The soft iron foundry will have a capacity of about 250 tons a day, and will have a moulding floor 560 ft. long, commanded by two 12½-ton and one 25-ton Shaw girder traveling cranes of 70-ft. span, arranged to pass through doors in the gable ends of the building and travel to the end of yard runways 280 ft. long, thus serving all requirements of loading, unloading, shipping, storage, etc.



Plan of Foundries, Power House, Storage Yards and Tracks.

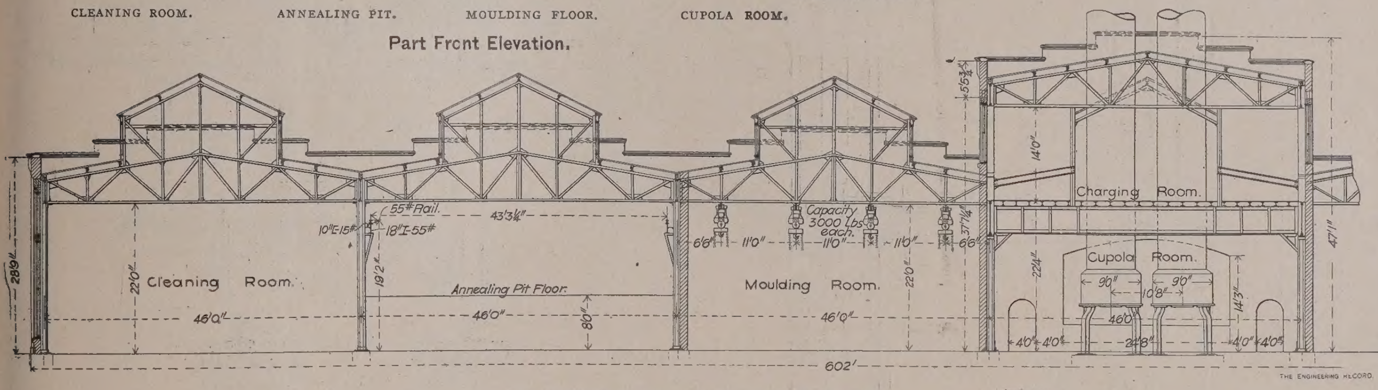
The wheel foundry has a capacity of 900 wheels in 10 hours, and is arranged on a special plan to secure the highest quality, largest output and lowest cost possible. It is designed for a continuous succession of operations simultaneously performed in many small groups and facilitated by a comprehensive system of power handling, intended to make the work as rapid and efficient as possible. Materials are received and product is delivered on outside longitudinal tracks, and all inside transportation is accomplished by narrow-gauge longitudinal cable tracks on opposite sides of the building on the surface of the ground and by numerous overhead transverse light trolley hoists. The building and equipment is symmetrical about the center transverse axis, and so may be considered to consist of two equal and independent divisions, but it is really made up of three complete sections, each consisting of a pair of 86-in. Paxson cupolas and twelve 25-wheel moulding floors, each commanded by an independent trolley hoist, but dependent on the general system of longitudinal cable cars for the delivery of molten iron and removal of wheels to either of two large annealing pits, one at each end of the foundry. This arrangement is very compact and efficient, and contemplates the installation of a complete system without progressive extensions. Future enlargement can best be accomplished by adding one or more pairs of cupolas and corresponding wheel floors in the longitudinal extension at either end of the present building and providing a proportionate increase of annealing pits.

Coke, pig iron, scrap and other stock are stored in the open air between the wheel and soft iron foundries, the coke bins being filled from standard-gauge cars, pushed up a trestle incline by a locomotive. Small steel flat cars are loaded by hand with the required class of pig iron and pushed on the scales in the weighing room, where the requsite amount of old broken car wheels is added to make a 4,000-lb. load. The car is then pushed on a turntable on the platform of a hydraulic plunger elevator, and raised to the charging floor, turned, pushed to either of the pair of cupolas and its contents charged by hand. A car load of coke follows every two cars of iron. The old wheels are broken near the scale house by a 1,700-lb. hammer falling on a concave anvil block bedded in the ground and enclosed in a wooden tower. The hammer is raised 20 ft. by a hydraulic plunger, and at the proper height the trigger engages a stop and releases the hammer automatically.



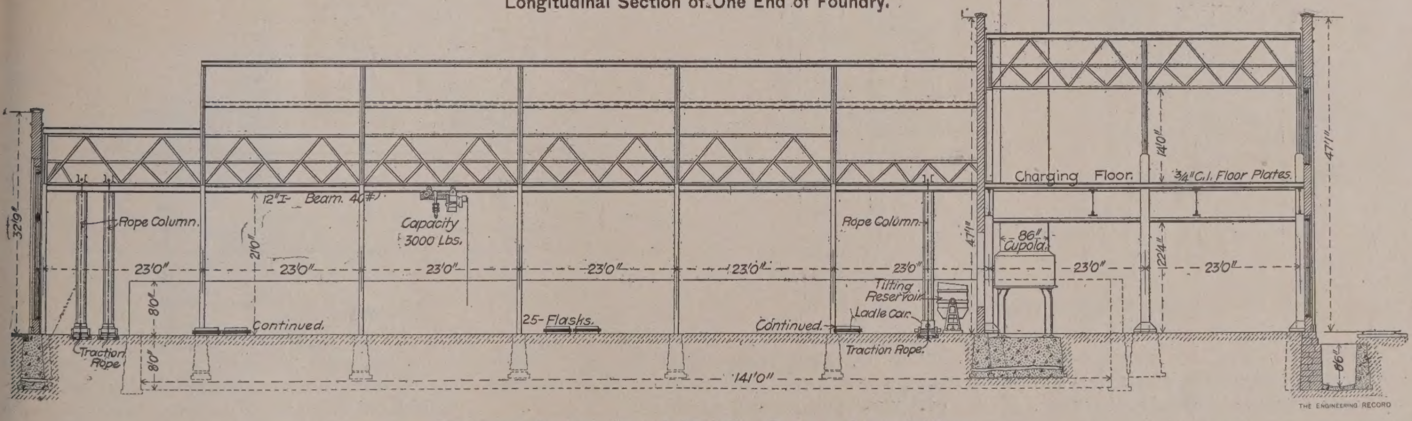
THE ENGINEERING RECORD.

Part Front Elevation.



THE ENGINEERING RECORD.

Longitudinal Section of One End of Foundry.



THE ENGINEERING RECORD

Transverse Section through Moulding Room and Cupola Room.

Some of the cupolas are provided with Sturtevant blowers driven by 60-h.p. General Electric motors, and others are provided with Sirocco blowers similarly driven. Each cupola discharges into a stationary reservoir of 14,000 lb. capacity, which is mounted on a horizontal axis and delivers to the 1,000-lb. ladles as required. Pairs of ladles are seated on low, flat 4-wheel steel cars, and the latter are coupled together 11 ft. apart on centers, in sets of four and pulled longitudinally in either direction across the ends of the moulding floors by a steel cable. Detachable bails on the transverse trolley hoists engage the ladle trunnions, lift them from the cars and traverse them to the moulds to be poured, commencing at the farther end of the floor. The ladle is rapidly moved in either direction and raised or lowered by electric motors controlled by suspended levers.

After the wheels are cast the flasks are lifted by the trolley hoists and the wheels are removed by them and placed on special cars on longitudinal tracks on the side of the building opposite the cupolas, commencing with those which were first poured. The wheel cars are coupled together in fours, 11 ft. apart on centers, to exactly correspond with the spacing of the rows of moulds, and all the operations are done in sets of four. The wheel cars are pulled by steel cable traction to the end of the annealing pits, and the wheels are lifted by automatic tongs suspended from the trolley hoist of a Shaw girder crane of 44-ft. span, which commands the annealing pits and has a runway extending beyond them across the floor of the cleaning room. It has five electric hoists, one for each of the four cars in a train, and an extra one for use if any of the others should be disabled. The wheels remain five days in the pits, and are then lifted out by the overhead crane and delivered to the cleaning floor, where they are turned on edge and the cores removed. They are then cleaned, inspected, measured and rolled by hand to the shipping platform, which is an elevated oak floor extending the full length of the foundry at a height of 4 ft. above the adjacent railroad track, thus providing storage for about 5,000 wheels and enabling them to be rolled into the cars at a moment's notice.

Each wheel has two sand cores, one for the axle-hole and the other for the space between the double webs. These cores are made in core rooms between two pairs of the cupolas, and are baked in special ovens of a pattern developed at the Altoona foundry. They are arranged in groups of three on opposite sides of the room, and are about 13 ft. sq. and 14 ft. high over all, built of fire brick, with arched tops. Underneath each oven is a coke furnace, fired from a pit under the core-room floor, and having two flues which deliver the gases to the rear corners of the oven at floor level. In the center of the oven there is a masonry pier on which is seated a vertical shaft with collars, which support independently seven revolving horizontal cast-iron shelves about 10 ft. in diameter and 11 in. apart vertically.

Between the two sets of ovens there is a 40x28-ft. sand bin with wooden walls about 12 ft. high, made with an outside framework of vertical and horizontal I-beams. Sand for the moulders' use is stored in a 40x80-ft. bin on the opposite side of the centre cupolas, and is sifted by an electrically-driven machine, manufactured by the Fairbanks Machine Co., Springfield, O. It is delivered in wheelbarrows to the moulding floors, each of which is 11 ft. wide, extends across the full width of the foundry, and has on the center line a pair of rails 24 in. apart, forming skids on which the 25 flasks are set by means of removable bails engaging their trunnions and suspended from the 2,000-lb. electric trolley hoists, which travel on the lower flanges of 12-in. I-beam runways.

The melted iron is run into reservoirs which have brick-lined steel shells mounted on trunnions so that they can be tilted and pour the metal into ladles on cars which distribute them to the different rows of flasks. The trunnions have bearings in cast-iron housings, beyond which they project to receive at each end a very short drum on which there is one turn of a chain. The two chains are wound in different directions, and the ends are carried down vertically and pass around guide sheaves to connect with the opposite ends of a hydraulic piston in the base of the housings. This piston is controlled by a lever near the ladle car so that the attendant can observe the flow of the metal and regulate it quickly and accurately.

The steel ladle cars are about 4 ft. wide and 8½ ft. long over all, and have a pair of longitudinal channels suspended from their axles, close to the ground, supporting a horizontal plate platform stiffened by 5x3½-in. flange angles and intended to receive on each end one 1,000-lb. ladle. These cars are coupled together 11 ft. apart on centers in trains of four, so that each ladle will be opposite a row of flasks, and thus four moulders are served at once. The cars are operated by an endless 7/16-in. steel rope, which runs between the track rails for a distance equal to the width of 12 moulding floors, and is led around guide sheaves, up the steel columns, and from their tops parallel with the part between the tracks and about 23 ft. above it to complete the circuit, the upper part being carried on rollers in a horizontal frame supported by the roof trusses. Two or three turns of the rope are taken around the drum of a reversible motor-operated driving apparatus, in the line of the upper part, and the bight is passed around a system of sheaves, two of which are adjustable, and have counter-weights pulling them against the stress in the cable, so as to maintain a constant tension and take up all slack and stretch. On the opposite side of the foundry there are two duplicate haulage systems parallel to each other and close together to operate the cars which deliver the wheels from the moulding floors to the annealing pits.

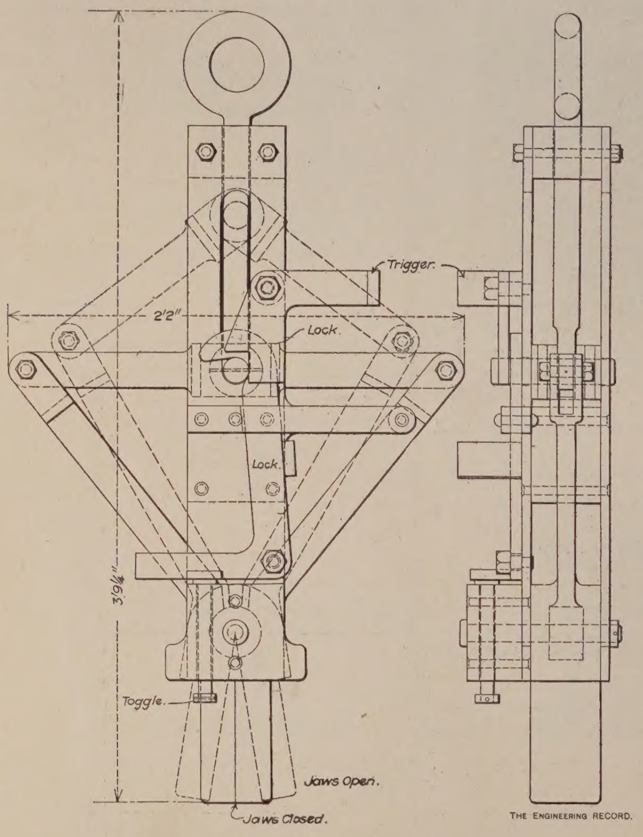
The car wheels are lifted by special pitting tongs, which engage the center hole with a friction grip, and release it when the wheel is deposited on any support. The jaws of the tongs are expanded by a toggle joint operated by the weight of the wheel, and guided by a connecting pin that travels vertically in a slot in the hoist bar. This pin is commanded by two triggers, which lock it until they are tripped by the tongs entering the wheel hub or are operated by hand, thus enabling the tongs to be set in advance and dropped to the bottom of the annealing pit and pick out a wheel, or, on the other hand, to lift a wheel from the car and release it as soon as it is lowered to the bottom of the pit. The wheels weigh from 500 to 800 lb. each, and are cast in contracting chills. Within a few minutes after pouring they are removed from the flasks and loaded on special 4-wheel skeleton steel cars of about 2 ft. 7-in. gauge, in four-car trains, running on the pair of Hunt industrial tracks leading to the annealing pits, as already mentioned. The wheel is placed on an angle-iron ring supported at four points from the framing of the car, and having an inclined platform or chute under it, so that the sand can fall freely through the ring and frame and be delivered by gravity to the floor outside the track in a convenient position to be disposed of without obstructing operations.

The two 41x140-ft. annealing pits are excavated about 9 ft. below the foundry floor and enclosed by masonry retaining walls, rising 8 ft. above the foundry floor, thus giving them an inside depth of about 17 ft. The bottom of the pit is covered with 6 in. of concrete sloped about 1:100, with tile drains to collect any moisture and deliver it to a sump at one end. Between the drains are four longitudinal horizontal concrete platforms 5 ft. wide, on each of which are seated 25 vertical sheet-steel brick-lined cylinders, 4 ft. in diameter and 16 ft. high, each with a capacity of 25 wheels, which are placed in them red hot, remain five days, and are too hot to touch with the hand when they are removed. Coarse broken stone is filled around the bottoms of the cylinder, then fine stone, and on top burnt sand, shale, etc., up to the tops of the retaining walls. The rows of cylinders are spaced 11 ft. apart, and care is taken in the selection of the filling around them to avoid the difficulty experienced in other pits where fine sand around the cylinders continually worked down and wedged against them so that when they expanded great pressure was developed, and they were crushed inwards and badly distorted, a difficulty which has been avoided here.

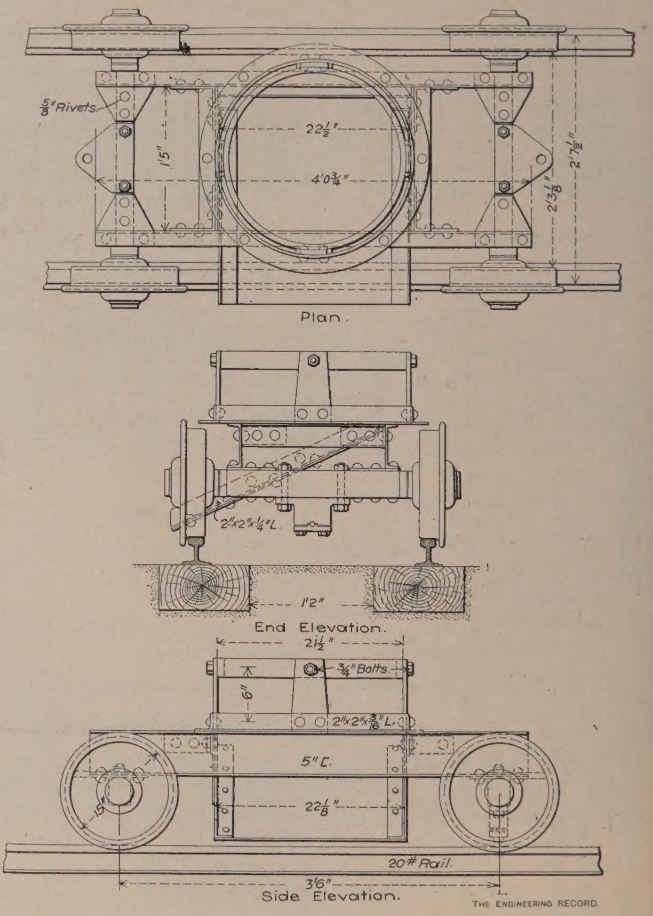
The interior of the foundry is a single undivided room, about 600 ft. long and 186 ft. wide, with no divisions between the moulding floors, annealing pits and cleaning rooms, but with a 60x410-ft. space on one side enclosed for the cupolas, sand, core, storage and wash rooms. These rooms have brick partition walls, and the two-story cupola rooms have special front walls, as indicated in the part elevation. The long side of the building is divided into thirteen 46-ft. bays, and each bay has nine riveted roof trusses in longitudinal planes, 23 ft. apart. The trusses are independent of the walls and partitions, and are supported on riveted steel columns arranged in fourteen longitudinal and nine transverse rows. Adjacent to the face walls and over the cupola rooms and other divisions of the building they are special, but over the main part of the building they are all regular as indicated in the sectional elevation of one end. The roof trusses support 25-ft. monitors, with ventilating windows in their clere-stories and skylights along each side of the peak.

Each bay in the foundry proper covers one unit of four moulders' floors, which are separated from the adjacent units by the transverse rows of columns. The roof trusses in each bay are connected by the purlins, roof sheathing and four lines of light transverse lattice girders transverse to the axis of the main building, with continuous lines of 12-in. I-beams attached to their lower flanges to carry 2,000-lb. Sprague and Pawling & Harnischfeger trolley hoists operated by 2-h.p. electric motors.

Near each end of the building there is installed



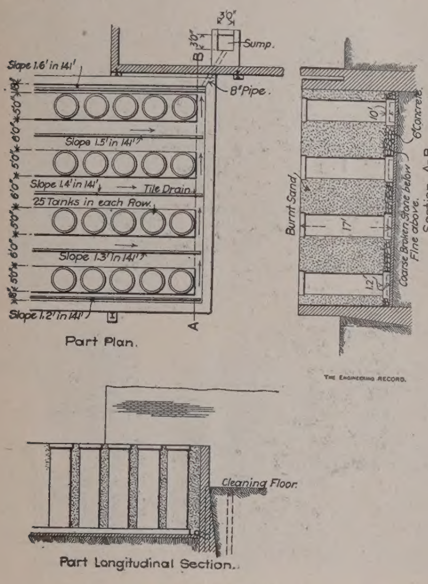
Pitting Tongs for Wheels.



Hot-Wheel Car.

a heating apparatus with large batteries of radiator pipes supplied from the exhaust of the engines in the power house or with live steam if necessary. The hot air is circulated through circular galvanized-iron distributing ducts in the roof trusses by large Sturtevant fans driven by 50-h.p. electric motors. At each end of the foundry there is a 44x48-ft. wash room partitioned off to include a dressing room with expanded metal lockers for 300 men, a toilet room with porcelain fixtures, a row of six shower baths and 50 porcelain wash bowl basins set in nickel-plated pipe frames and supplied with hot and cold water.

The 89x161-ft. power house is divided into nearly equal parts by a longitudinal brick partition wall.



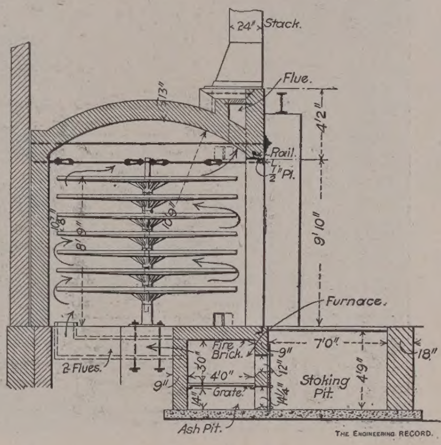
Part Plan.

Part Longitudinal Section.

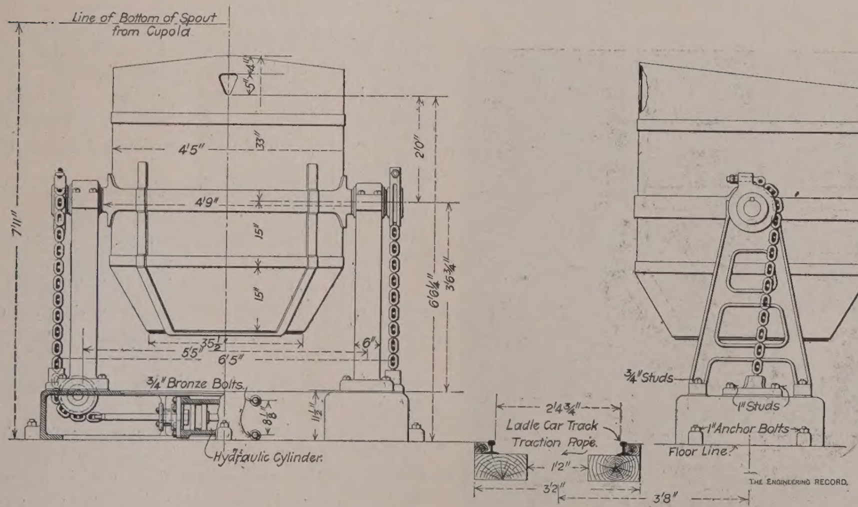
Annealing Pit.

The basement is excavated about 4 ft. below grade and the engine room floor is 4 ft. above grade. There are eight 260-h.p. Babcock & Wilcox boilers equipped with Roney stokers, two Worthington feed-water pumps, one feed-water heater, and two vacuum pumps. Soft coal is received on a surface track at the end of the building, dumped in a hopper under the track, which delivers to a crushing machine, from which it is elevated and conveyed by Hunt conveyors to an overhead hopper-bottom steel bin supplying the mechanical stokers. At one end of the boiler room there are installed two Epping-Carpenter triple-expansion pumps which deliver water at 500 lb. pressure to two weighted accumulators for use in operating the cupola elevators, wheel breakers and hot metal reservoirs. Compressed air for foundry purposes is furnished by two compound Franklin air compressors, each of which is able to deliver 700 cu. ft. of air per minute at 100 lb. pressure to the coolers, from which it is delivered throughout the plant. Two 10-h.p. motors are installed in the basement to operate the coal-crushing and conveying plant. Two 3-in. motor-driven centrifugal pumps drain the water collected in sumps in the ash tunnel below sewer level.

The engine room is commanded by a Morgan & Wright 12½-ton traveling girder crane of 40 ft. span, provided with an auxiliary hoist and operated by four General Electric motors. There are two 300-kw., 250-volt General Electric generators coupled to Wetherill cross-compound Corliss engines, making 120 r.p.m.; two 500-kw., 250-volt Westinghouse generators, coupled to Wetherill cross-compound engines making 100 r.p.m. and one 50-kw., 250-volt General Electric generator driven by a Harrisburg engine and used chiefly for lighting purposes in the summer. The engines are furnished with Monarch automatic stops. All motors are of the direct-current type, operated at 230 volts, the wires being carried underground to the different buildings. There is, throughout the plant, a complete Gamewell electric fire alarm system. The shops are provided with 110-volt arc lamps operated two in series.



Core Oven.



Cupola Discharge Tilting Reservoir.

Construction was commenced at the site June 24, 1903. Work was commenced in one-half the wheel foundry on November 7, 1904, and it is expected that the wheel foundry will be in full operation by May 1 and that the soft iron foundry will be in operation by July 1.

This plant was designed and constructed under the direction of the Motive Power Department of the Pennsylvania Railroad.

The Cost of Reinforced Concrete Sewers.

While there has been a great deal of discussion of late concerning the design and execution of works in which reinforced concrete is used, very little information concerning its cost has been published. Acordingly, some figures recently given by Mr. Walter C. Parmley, of New York, in a recent paper read before the Boston Society of Civil Engineers, are of much interest. They referred to the work done on sewers in Cleveland during the last three years.

About 3½ miles of main intercepting sewer, 13½ ft. in diameter, with a short section 12 ft. 9 in. in diameter, and upwards of 4 miles of other sewers, ranging from about 5 to 12 ft. in diameter, have been put under construction in Cleveland, and most of them completed. Some of the contractors, who built the sewers, preferred to use hand-mixed concrete, while others used machine mixers. The results given by Mr. Parmley were obtained where hand-mixed concrete was employed. The sewer gangs soon devised a plan of division of labor, so that, except in case of accident or special contingency, the work went on quite regularly, day by day. The common laborers were mostly Italians, while the more skilled work was performed by Americans.

The steel skeleton consisted of 2x½-in. bars, 15 in. on centers, with a few 1½x¼-in. longitudinal bars. Two rows of anchor bars were set in the side walls, and the top bars were attached by bolts. The metal required no bending in the field, as it was accurately shaped in the mill. The weight of metal per lineal foot of the 13½-ft. sewer was about 93 lb. The concrete arch was 12 in. thick at the crown and 15 in. thick at the springing line. The time on which estimates are made was reported by an inspector, who was continually on the work. The first observation covered two days' work under average conditions, the workmen and the contractor not knowing that notes were being taken. The figures given, however, are for one day's work.

The labor required in placing anchor bars for 40 lineal feet of sewer, or about 1,504 lb. of metal, was one man at $3.50 per day, one man at $1.75, and one man carrying steel for 4 hr. at 20 cents, making a total of $6.05, or 0.4 cents per pound of metal. The concrete gang on the sides consisted of five men wheeling and mixing, one man tamping, and one man carrying concrete, all at $1.75, and two-thirds of one man's time lowering brick and concrete, at $2.25, making a daily total of $13.75 for labor in building 40 linear feet of side wall of the sewer. This length contained 13 cu. yd. of concrete, so the cost of labor per cubic yard was $1.06, the concrete being tamped behind the brick lining as the latter was built up by the masons.

The labor necessary to place a single ring of the brick lining at the sides in a length of 40 ft., was two masons at 70 cents per hour, one man mixing mortar at $2.25, three men wheeling sand, filling buckets and dumping at $1.75, and one-third of a man's time lowering materials at $2.25, with a total cost of $19.45. The quantity of brick masonry laid in this length was 6.38 cu. yd., making the labor cost $3.05 per cubic yard.

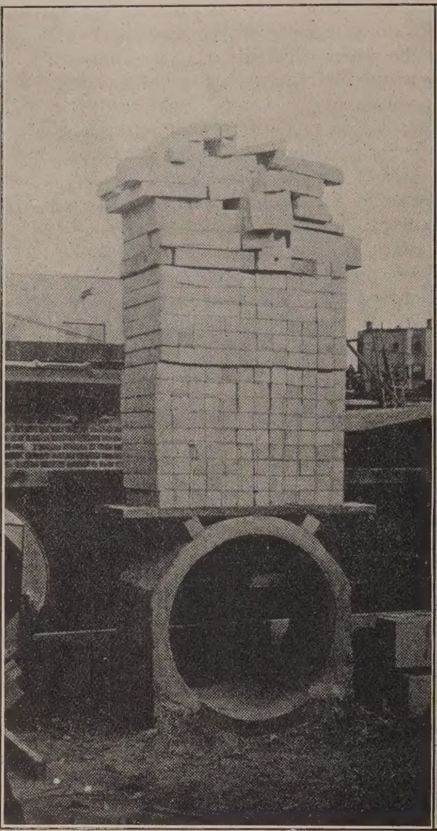
An account was kept of the labor performed on 85 linear feet of arch work, built at the rate of 14 1/6 ft. a day. The force employed was one man putting mortar lining on center ring, two men mixing mortar, screening and wheeling sand, one man tamping concrete, and eight men on the mixing board, all at $1.75 per day, making the total daily labor bill $24. This force placed 25.64 cu. yd. per day, so the labor per cubic yard cost 82 cents.

In placing the centering and arch bars two men worked on the centering and steel work at $1.75 and one man at $3.50. These men placed the centering and arch bars for 14 1/6 linear feet of sewer each day, at a cost of 49 cents per linear foot. As nearly as could be judged, about two-thirds of their labor was required in erecting the centering and the remainder in putting the steel in place. The steel was placed at the rate of 785 lb. per day, making the labor charge .3 cents per pound, and the cost of erecting and moving the centers 33 cents per linear foot of arch.

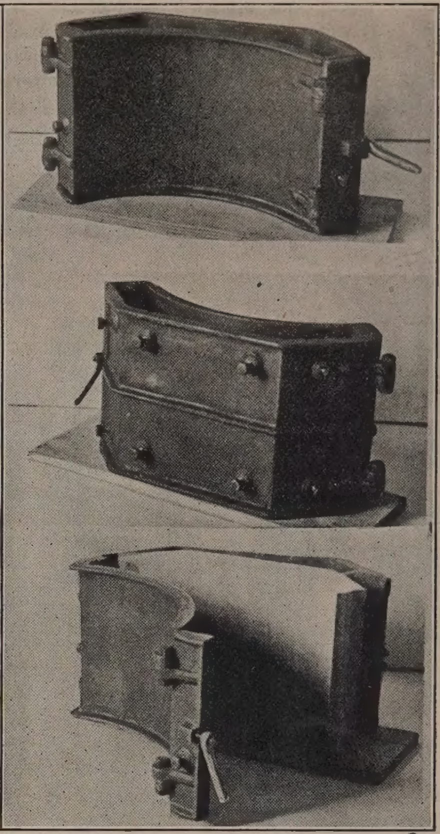
Another record on 39.27 ft. of sewer on a curve gave the cost of the brickwork at the sides the same as stated above, but the inspector's record of men working on concrete backing at the sides showed a less cost than in the former case. The cost of this work in the latter instance was four men mixing and one man in the bottom at $1.75 per day, and two-thirds of one man's time lowering materials, at $2.25; a total of $10.25 for the 12.7 cu. yd. laid daily, or 81 cents per cubic yard. This figure probably more nearly represents the average cost, Mr. Parmley says, than the $1.06 per cubic yard, reported in the first instance.

The labor required in placing the anchor bars on straight sewer at another time, representing average progress, was found to be one man at $1.75 and one at $3.50, who placed the steel for 44 linear feet of sewer, or 1,650 lb. at a cost of .32 cents per pound.

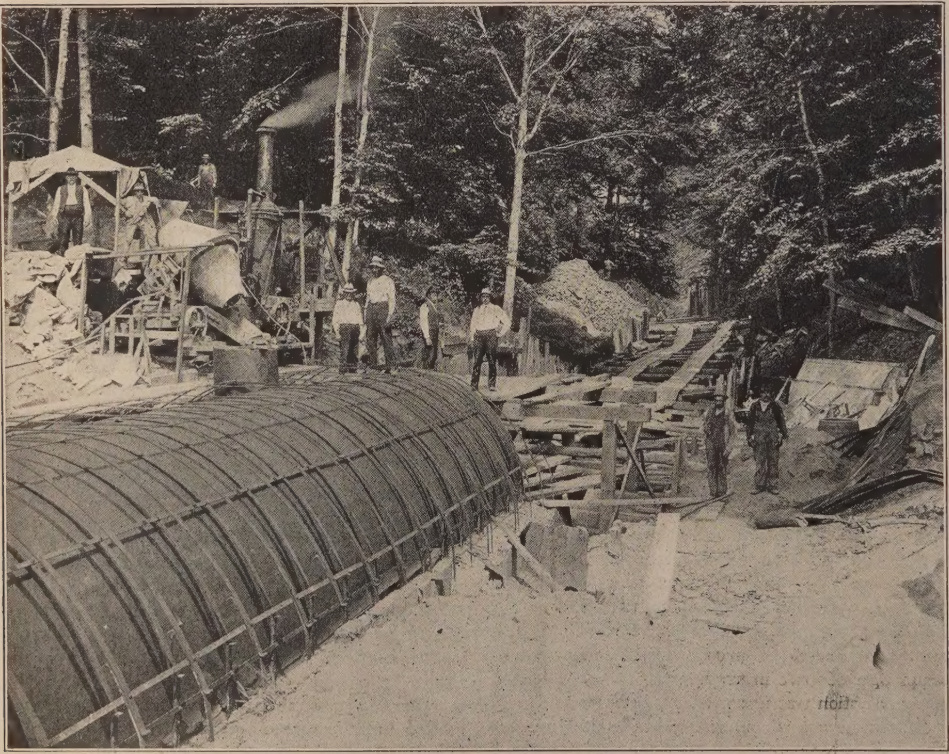
Further notes were taken for 6 days, when the work seemed to represent as nearly as possible the general average of the whole. In this case the labor on 13 1/6 linear feet of arch concrete, containing 11 cu. yd., was seven men mixing concrete, one man plastering the center and one tamping at $1.75, and one man mixing mortar at $2, a total of $17.75. On straight arch work they placed 24.1 cu. yd. a day at a cost of 74 cents per cubic yard. In three days' work on a curve the same gang placed 26.37 cu. yd. daily at a cost of 67½ cents per cubic yard. Two men at $1.75 and one man at $3.50, kept up with this gang in erecting the centering and placing the steel for the arch, making the cost about 54 cents per linear foot of sewer. Two-thirds of this labor, or 36 cents per lineal foot, was for centering and 18 cents per linear foot placed the steel ready to be imbedded.



Test Load on a Section of Block Sewer.



Forms for Concrete Sewer Block.



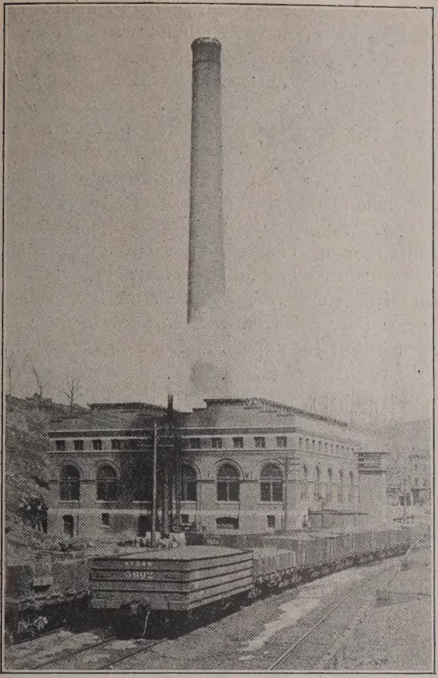
Reinforced Concrete Sewer Construction at Cleveland.

For the double-ring brick lining at the bottom the regular daily rate of progress was 28 ft., or 11.15 cu. yd. Two brick masons at 70 cents per hour, five men at $1.75 per day, and one at $2.25 were required to lay this amount of lining, with a total cost of $22.20, or $1.98 per cubic yard.

Other observations on the cost of placing the steel skeleton and concrete did not vary materially from the figures given. No charges for superintendence or general expenses are included in the estimates of the cost, as such charges were not obtainable. On another contract, where machine mixing was employed as much as 36 linear feet of arch on the 13½-ft. sewer, were built in a day, but no cost data were taken, although the cost was evidently less, Mr. Parmley believes, than it was where hand mixing was employed in making the concrete.

The design of the intercepting sewers on which the foregoing data were obtained and the methods followed in their construction were described in The Engineering Record, Aug. 29, 1903.

Contractors sometimes object to bidding low on small concrete sewers, especially when the concrete is reinforced, Mr. Parmley says, their objections being that the trench is too narrow for convenient working, that the thin walls make the cost per unit of volume proportionately high and that there is greater danger of carelessness on the part of the workmen. These objections are serious only on sewers less than 4 ft. in diameter, he believes, and may be avoided by the use of suitably designed and manufactured concrete blocks. The material for the blocks should be well graded, with ¾-in. fragments as the largest pieces and with a considerable surplus of mortar to make a dense concrete. A 1:3:4.5 mixture will give good results, he states, and a 1:2:3 mixture, a superior quality of concrete. It is desirable to coat the inner surfaces of the blocks before they have acquired any considerable hardness with a paint of neat cement. The reinforcing steel should be set in a thin mixture of 1:2 Portland cement, or for special cases, a 1:1 mortar. As no centering is required for the smaller sizes they can be built conveniently in a narrow trench, there is no danger of spots of poor concrete, the sewer can be backed up with well-tamped earth, which cannot usually be done in monolithic construction, and the invert blocks can be easily and accurately laid in a wet trench.



THE POWER HOUSE.

The Weehawken Elevator of the New York Central & Hudson River R. R.

By J. C. Irwin.

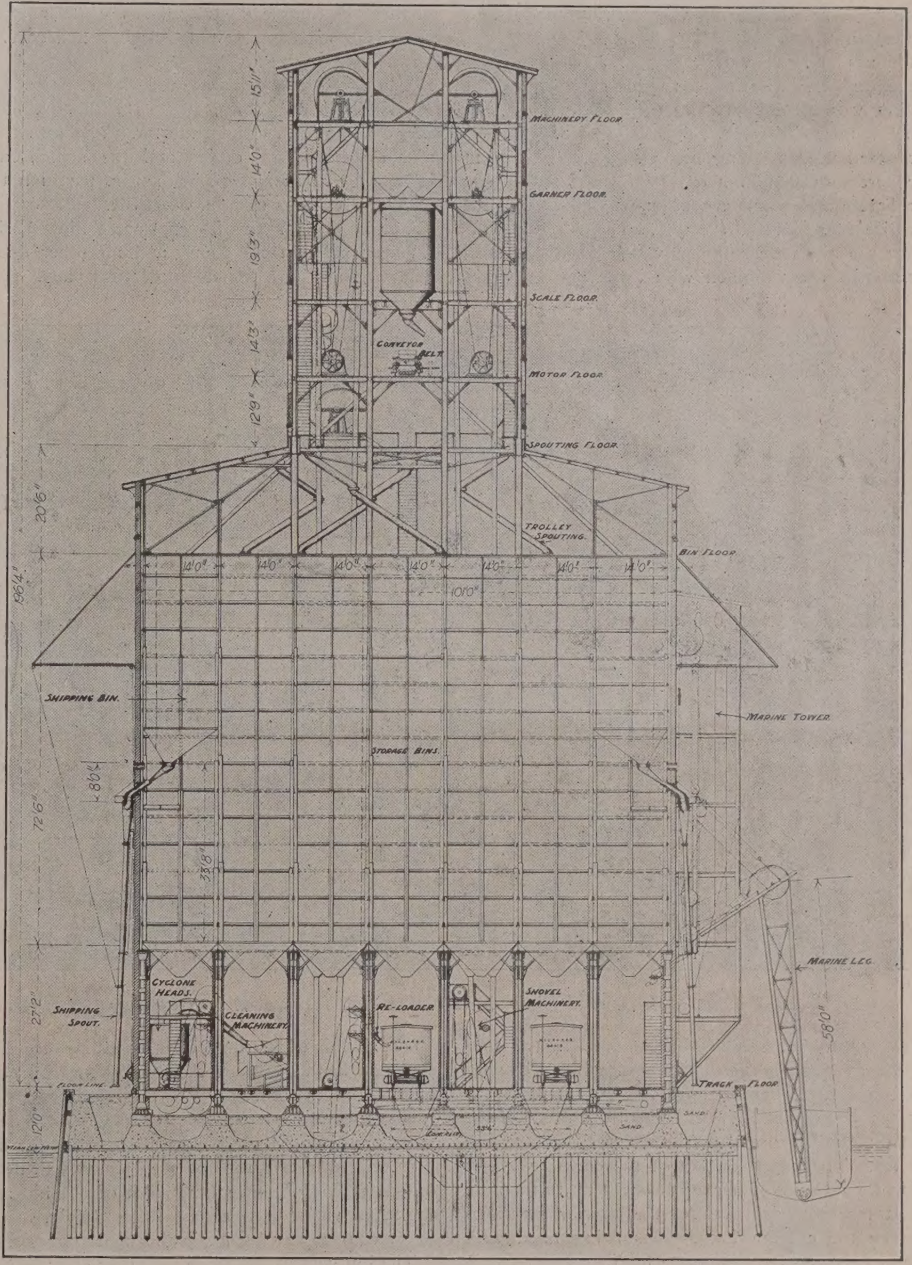
For many years the New York Central & Hudson River R. R. has had the largest grain elevator capacity of any railroad on New York Harbor. The elevator at the 60th St. yard in New York City, rebuilt in 1890, has a capacity of 1,500,000 bushels, and the West Shore elevator on Pier 8, at Weehawken, built in 1883, has a capacity of 1,200,000 bushels. The completion of the new 2,000,000-bushel fireproof elevator on Pier 7, Weehawken, increases the New York Central elevator capacity 76 per cent., and gives this company a capacity of 4,700,000 bushels, which is greater than that controlled by all other railroads on the harbor combined.

A better idea of the meaning of 2,000,000 bushels may be had from the statement that it would require approximately 1,500 modern 80,000-lb. capacity box cars of grain to fill the elevator and that this number of cars would make up a string twelve miles long. The receiving capacity of the elevator is 21 cars, or 28,000 bushels, per hour, which would amount to about 500 cars, or 670,000 bushels, in 24 hours.

General Arrangement.—The main features of this new elevator, which is marked "2" in the accompanying perspective view of the Weehawken terminals, are that it is absolutely fireproof, being built of brick, concrete and steel; it is available for use by deep draught vessels, having 32 ft. of water at mean low tide in the slips on both sides of the elevator; it is designed for quick handling and is operated entirely by electricity, furnished by a power station 1,000 ft. distant. It is fully equipped with dust collectors, by which the dust is picked up by suction and disposed of outside of the building. Rope drives are used for the machinery to avoid electric sparks from the use of belts, and the motors are all enclosed in dust-proof cases, to the interior of which fresh air is admitted through ducts from the exterior of the building.

The main building is 101 ft. 6 in. wide by 354 ft. 2 in. long and 200 ft. 8 in. high from the top of the foundation masonry to the ridge of the cupola roof. Two tracks pass through the building, and the tail tracks extend on to the dock so that cars can be shoved through the building.

A short description of the method of operation may lead to a better understanding of the construction. The grain is delivered from the cars into eight double-track hoppers, extending from the outside rail of each track to the foot of the elevator legs. The cars are unloaded by machine shovels guided by hand. After being dumped into the hoppers, the grain is elevated to the garners by means of continuous belt elevators, with sheet iron buckets extending from the bottom of the hoppers on the basement floor up to the top of the garners, which are located on the next to the top floor of the cupola. From the garners, which are 23 in number, the grain is delivered into the scale hoppers on the floor below, where it is weighed before being distributed into the various bins. There are in all 23 scale hoppers; eight designed for receiving, each of which has a capacity of 2,000 bushels, and 15 designed for shipping, transfer and cleaning, each of which have a capacity of 800 bushels. From the scale hoppers the grain is delivered to a belt conveyor supplied with two trippers on the floor below, and by means of this conveyor it is distributed to a series of 40 trolley spouts, by means of which it can be delivered directly into any bin desired. The bins along the exterior are divided into two sets, vertically, the upper set being used for shipping bins for loading into boats, and the lower set being used for storage. The boots on the exterior of the building connecting with the bottom of the shipping bins enable those bins to be emptied directly into the boats.



Cross-Section through 2,000,000-Bushel Elevator at Weehawken.

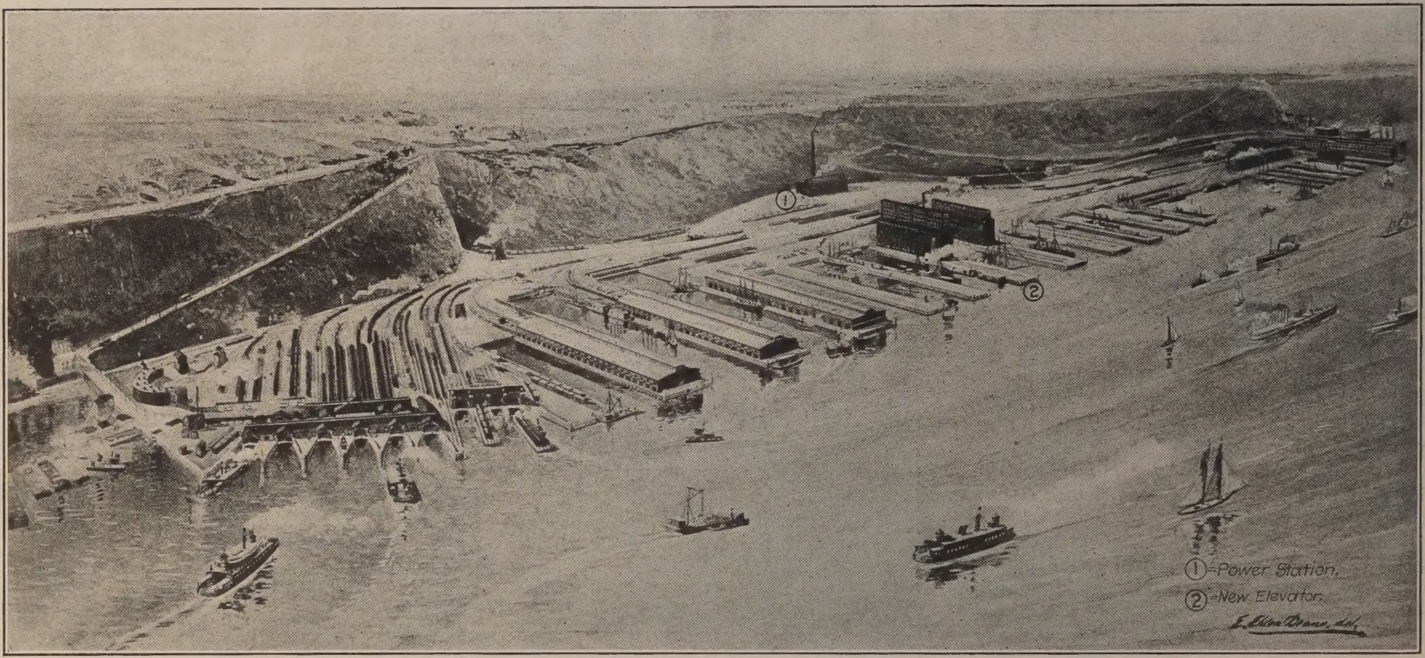
For the purpose of unloading boats into the elevator, a marine leg, enclosed in the steel tower, is provided near one end of the building. This delivers into the marine garner from which the grain can be delivered wherever desired. In order to transfer from one bin to another, there are eight cross-belt conveyors under the first floor.

For cleaning the grain, fourteen compound shake separators, each with a capacity of 5,500 bushels per hour, are provided.

A car puller, capable of handling 20 loaded cars, is arranged so that it can handle cars on either track.

Foundations.—In the construction of this elevator the foundations were particularly expensive, as the river mud and silt runs to a depth of from 75 to 110 ft. below mean low water, and under this is fine sand running to a depth of 88 to 114 ft. below mean low water before reaching hard sand bottom. It was found necessary to drive piles an average depth of 116 ft. The piles were spliced by the use of a 1½x18-in. dowel in the center of the butt joint and around the outside six 3x6-in. white oak strips 16 ft. long, each secured by 10-in. spikes. The upper sections of the piles are from 60 to 75 ft. long, varying in length so that the splices will not come in the same horizontal plane.

In building the foundation a space about 126 ft. wide and 390 ft. long was dredged to a depth of 8 ft. below mean low water. The 3,842 piles forming the foundation were then driven and cut off at a uniform level of 3 in. below mean low water. The substructure, including the exterior concrete bulkhead wall, was entirely enclosed by 12x12-in. sheet piling 50 ft. long, formed with tongues and grooves by 2x4-in. strips spiked to the timbers. The interior space surrounding the piles was filled with sand up to a level of 1 ft. below mean low water, and the surface was then covered with a course of 1 :3 :5 Portland cement concrete of a minimum thickness of 3 ft. The concrete also forms a continuous wall around the entire four sides of the pier. The piles supporting the rows of columns which form the steel structure are arranged with three rows of piles to each set of columns. Embedded in the concrete over the heads of the piles are two courses of steel rails, one running transversely and the other longitudinally, designed to distribute the load and take up any tensile stresses that may develop. The upper portion of the concrete bed is formed in inverted arches, brought up to the base of the column foundations, the interior space between the column foundations being filled with sand to support the concrete floor.



General View of the Weehawken Terminal of the New York Central Lines, West Shore Division.

Superstructure.—The main walls of the building are of North River brick laid in cement mortar to a height of 32 ft. above foundations, and above that point in lime mortar. The brick walls extend up to the tops of the bins and above that point the roofs of all the bins, the side walls of the cupola and the roof of the cupola are all constructed of tile, supported by the steel structure.

The interior steel frame of the building is made up of eight rows of 26 columns each, spaced 14 ft. centres. The middle four rows of columns are extended to the top of the cupola, which is 44 ft. 2 in. over all and 96 ft. high above the main eaves, and extends the full length of the building. Its walls are of 8-in. partition tile, and it is divided into five stories, used for machinery, garners, scales, motors and distribution of the grain.

The floors, with the exception of the bin floor, are of concrete and expanded metal construction 4 in. thick, the lower portion consisting of 1 :3 :6 Portland cement concrete made with ¾-in. stone, and the top finish composed of 1 :1 cement mortar.

The bin floor and also the roof over bins and cupola are of 3-in. book tile, laid on T irons, the bin floor tile being also covered with cement mortar. Over the book tile forming the roofs is laid a pitch and gravel roofing composed of five piles of No. 28 felt, cemented together with best quality of American straight-run coal-tar pitch, coated with natural Trinidad asphalt and covered with white beach gravel.

The first floor columns and the exterior columns of the cupola are encased with 3-in. book tile, covered with cement mortar. The foremen's and weightmasters' offices and the switchboard room are partitioned off with 4-in. partition tile and have ceilings of 3-in. book tile.

The large doorways for cars are equipped with Kinnear patent steel doors, and all other doors and windows have fire doors of steel plate.

The building is completely piped for fire service and has 48 outlets, each equipped with hose on a swinging rack.

The bins are rectangular and are 72½ ft. deep from the top of their hopper bottoms to the bin floor. They are formed of steel plates 5 ft. deep, of one piece for the entire width of the bin and the metal varies in thickness from 5/16 in. in the lower courses to 3/16 in. in the upper courses.

The bin capacity is made up as follows:

59 regular bins, 11,700 bushles each............	690,300
138 one-half bins, 5,850 bushles each............	807,300
48 bins each side of legs, 4,500 bushels each..	216,000
23 bins under shipping bins, 4,900 bushles each	112,700
23 shipping bins, 5,200 bushels each..........	119,600
	1,945,900

Including the capacity of garners and scale hoppers, the total capacity is brought up to 2,010,700 bushels.

The garners and scale hoppers are also built of steel plate, the bottoms being 5/16 in. thick and the walls ¼ in. thick.

There are 24 elevator legs, containing continuous bucket elevators, used as follows: Eight receiving elevators for unloading cars, eight shipping elevators for loading purposes, seven transfer elevators for transfer and cleaning purposes, one elevator for screenings, and one marine elevator on the exterior of the building.

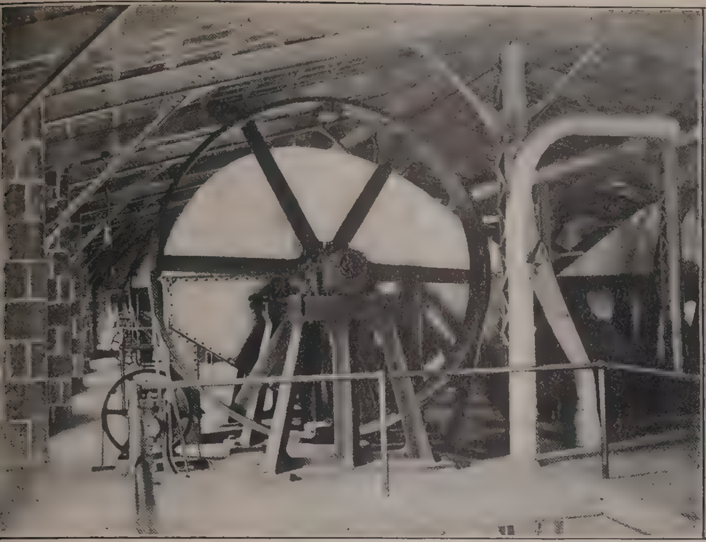
A brick stair tower on the land end of the building encloses an iron stair reaching from the first floor to the topmost floor of the cupola, and also a 5x6-ft. passenger elevator of 2,000 lb. capacity with a speed of 75 ft. per minute, which also operates to the topmost floor, with intermediate landings to the other floors. One spiral stair encased in an iron tower at the river end of the building reaches to the bin floor without intermediate landings. There are also several interior iron stairs reaching from the basement to the first floor and from the bin floor to the various floors of the cupola, and one flight reaching to the roof.

All iron work was painted in the shop with one coat of New York Central standard red lead paint, and during the erection the interior work received one additional coat and the exterior work two additional coats, the first being red lead and the second, white lead.

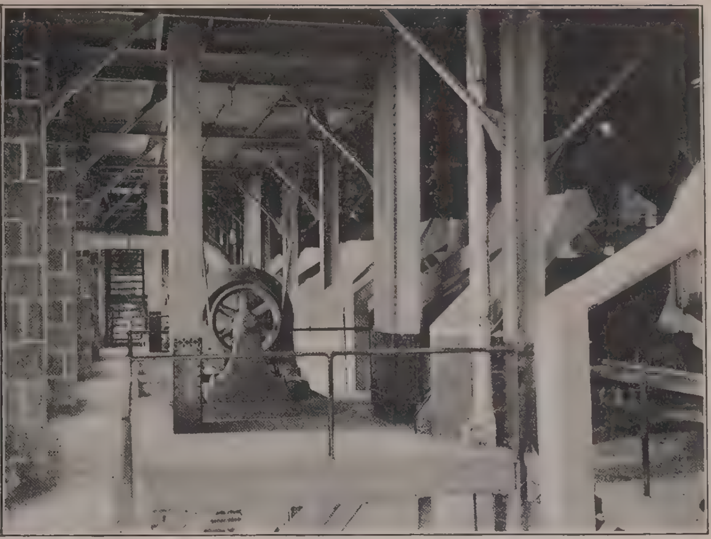
Power.—The machinery is driven by 43 motors, all of three-phase induction type, without brushes, and designed to operate on a multiphase alternating current circuit of 25 cycles per second, with a pressure of 550 volts. Of these motors, 23 of a capacity of 100 h.-p. each, are used for the operation of receiving, shipping, transfer and cleaning elevators; two, with a capacity of 60 h.-p. each, for operating the dust collectors and the belt conveyor in the cupola; 17, with a capacity of 40 h.-p. each, for cleaning machines, car puller, marine tower, screenings elevator, cross conveyor and dust collector fans, and one of 10 h.-p. for the passenger elevator, to which it is connected direct.

Light for the building is furnished by 328 16-c.-p. lamps inside and 78 32-c.-p. lamps, arranged in clusters of three on the outside, lighting the dock. The power station from which the current for the elevator is obtained is of recent construction and is also used to generate current for the railroad station and yards, docks, transfer bridges, and the marine shop where the floating equipment is repaired. It is an excellent example of modern power station design, both in interior arrangements and in the building itself, which presents a very attractive appearance.

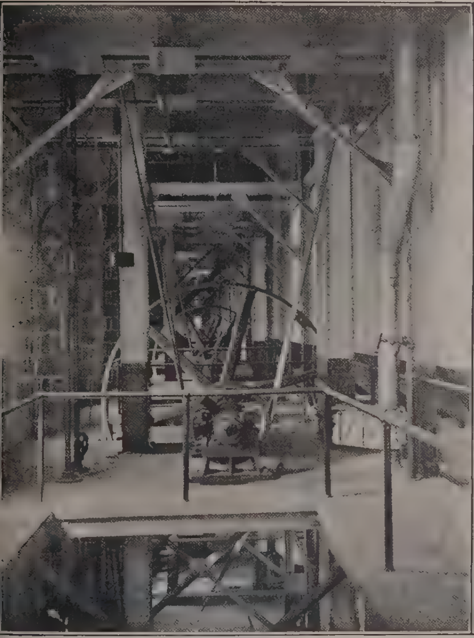
There are four boilers of 500 h.-p. each, set in pairs, one pair on each side of the stack, fitted



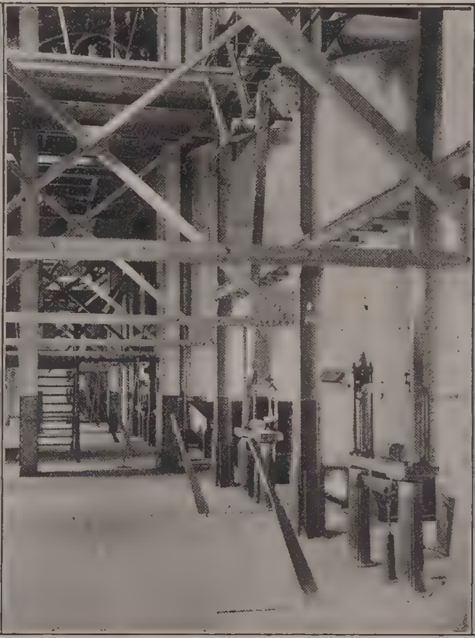
MACHINERY FLOOR.



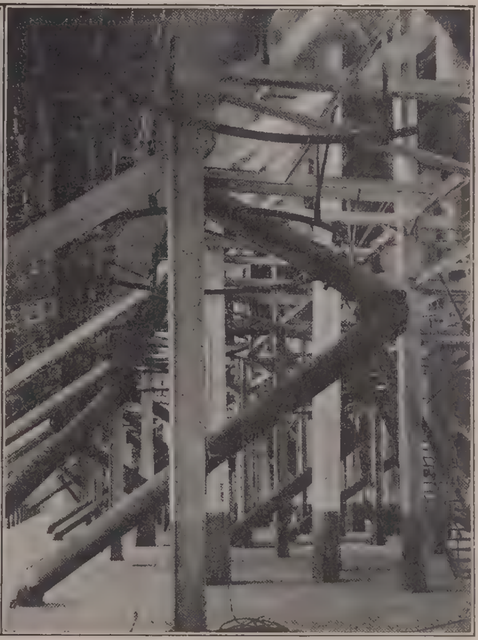
MOTOR FLOOR.



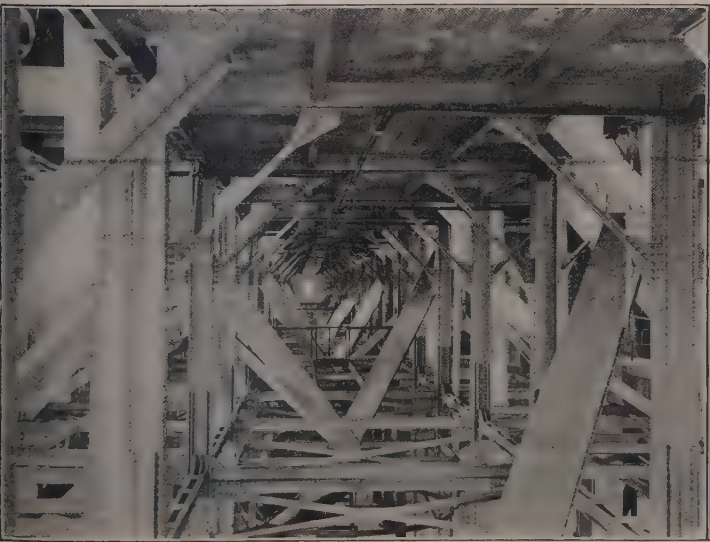
GARNER FLOOR.



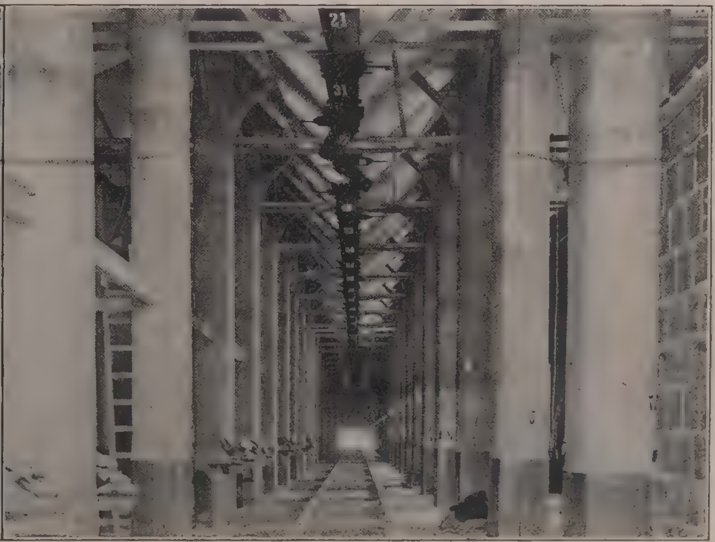
SCALE FLOOR.



BIN FLOOR.



SPOUTING FLOOR.



TRACK FLOOR.

VIEWS IN THE NEW 2,000,000-BUSHEL GRAIN ELEVATOR OF THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD COMPANY.

with a complete set of Roney mechanical stokers.

Coal is received from cars on a trestle alongside the boiler room, and after passing through a hopper into a crusher, is conveyed mechanically to bins over the boiler room, from which it is fed to the stokers by gravity. The ashes are also disposed of mechanically by being picked up and elevated with conveyors and deposited in bins overhead at an elevation from which they can be delivered into cars.

There are four three-phase alternating current generators, all driven by Westinghouse-Corliss engines. Two of these generators have a capacity of 750 kw. each and furnish current at 600 volts with a frequency of 25 cycles for power purposes. The other two have a capacity of 400 kw. each and furnish current at 2,300 volts, with a frequency of 60 cycles for lighting.

The work on both the elevator and the power station was executed under the direction of Mr. Wm. J. Wilgus, vice-president of the New York Central & Hudson River R. R., in charge of construction, who was chief engineer of that company at the time the plans were made and the work commenced. Mr. H. Fernstrom, the present chief engineer of the company, was assisted in the supervision of construction by Mr. Olaf Hoff, engineer of structures, Mr. E. B. Katte, electrical engineer, and Mr. Joseph Stehlin, mechanical engineer. Messrs. George M. Moulton & Co., of Chicago, were the architects and contractors for the superstructure and equipment of the elevator. Mr. Bernard Rolf was the contractor for the substructure.

The Use and Abuse of Wire Rope.

Wire rope is employed so extensively that it is rather surprising so little information concerning it has been published, even in the pamphlets of rope makers. The paper on the subject recently read before the mechanical section of the Engineers' Society of Western Pennsylvania by Mr. L. C. Moore accordingly has the merit of considerable novelty. It was confined to cast steel and the higher grades of rope, and was introduced with a short explanation of the methods of preparing wire for these grades.

Nearly 90 per cent. of all the stock of steel for rope wire is imported either in the form of billets, wire rods, or partially manufactured wire. Steel rods for rope are always larger than No. 6 B.W.G., 0.203 in., owing to the comparative higher tariff on smaller sizes.

The analysis of wire rope rods is, viz., either acid or steel for cast steel rope:

Element.	Extra Strong.	Plow Steel.
Carbon	0.47—0.58	0.65—0.70
Manganese	0.20—0.30	0.35—0.50
Silicon	Trace	Trace.
Phosphorus, max.	0.035	0.035
Sulphur, max.	0.035	0.035

The rods are cleaned, i.e., the scale and rust, if any, removed by means of sulphuric acid diluted with, say, 95 parts of water which is heated to a boiling point. The coils weighing from 60 to 100 lb. are immersed in the tubs on wood reels, and the process of cleaning usually requires about 30 min. They are then removed by hooks or crane and thoroughly washed with water and kept wet until they are "water coated." This term is more clearly understood by the following explanation: that the rods being entirely free from scale and rust immediately commence to oxidize again, and if kept wet for some time, a coating forms on the surface that is afterwards utilized in drawing or reducing to the diameters required. After they have been thus prepared they are thoroughly coated with a solution of lime, commonly known as "white wash," and, of course, further oxidization is at once prevented, provided, however, they are in the meantime carefully dried. The rods must now be baked, as during the cleaning process they have taken up a certain percentage of an element from the sulphuric acid, and they cannot be drawn until all of this has been eliminated, and this can only be done by baking, and requires a heat of about 400° Fahrenheit, and for a period of not less than 10 hours. Elaborate experiments have so far not developed any superior or quicker process than that above mentioned.

The author then explained the process of drawing, which it is hardly necessary to take up in this place. Those who wish to read this paper will find it in the February "Proceedings" of the Society. In the drawing from a diameter of 0.2 in. to 0.15 the steel has been hardened to such an extent that further reductions cannot be made without injury until the stock has been annealed or tempered, also recleaned, coated and baked. If the former, this must be done with what is called a muffler, this being a furnace so constructed that coke, oil or gas can be used as fuel; soft coal being too high in sulphur for the purpose. The furnace must also be so constructed that no iron in same lower in carbon than the stock itself comes in contact with the wire, because if so the tendency will be to decarbonize and thus injure the latter.

Therefore, it follows that a better grade of rope wire can be made by not using this form of annealing, but rather the continuous or tempering process, by which means no dangerous flames or fumes of any description can come in contact with the wire, thus preserving all the elements that are advantageous in making the best rope wire. Another feature of this latter process is the wire being drawn into the heating tubes of the furnace from the coil, the heat of same being kept at exactly the proper temperature.

After reducing the rods from .200 in. to .155 in. tempering or annealing by the continuous process, again cleaning, coating and baking the wire even with more care than the first time, the stock is now ready for a further reduction. After the first drawing and continuous annealing process, the quality of the stock has been improved, and this being the case the wire can be reduced four or even five drafts without annealing or injury. Rope wire of 0.155 in. diameter, after being properly treated, can be reduced to 0.097 in., after which, if further reductions are required, it should be treated in precisely the same manner as those already described.

The best quality of cast steel or rope of any prescribed strength is that in which the wires of same are the most uniform in the bending and tensile strength tests. Neither torsion nor elongation as tests are of any importance, in Mr. Moore's opinion, in determining the quality of rope wire in the testing department. If the manufacturer, in making up a stock reel of, say, ⅝ in. diameter 6x19 cast steel rope, permits a variation of more than 5 per cent. in tensile strength, and the same in bends, then this rope will not in all cases show good service, but if both tests are confined to, say, 2 per cent. variation in each direction, the quality of the stock reel will be perceptibly improved. If wire is used in rope varying from 160,000 to 180,000 lb. per square inch, there will be a difference in resistance to bends. Therefore it follows that it is not always safe to depend on determining the probable life of a partly-worn rope by counting the number of exposed broken wires to the foot or yard. Neither does it follow that because one-half of all the wires exposed are broken that it is time to abandon its use or procure a new rope. It may be that the factor of safety is high and that with one-half of all the wires broken the rope is more pliable than when new; and to sum up the fact of one-half the wires being broken usually proves that either a smaller diameter or more pliable rope should have been purchased in the first place.

There is an impression that sometimes a rope is made with a bad spot in it running, say, several hundred feet long. This is utterly impossible, Mr. Moore says, for the following reason: Take, for instance, a piece of ⅝-in. diameter 6x19 cast-steel rope, which would be a total of 114 wires in all. Now, the size of wire used for this rope weighs 23 lb. to the mile, and as before stated, drawing same several different times has developed the majority of bad spots; and even if not, it is impossible in a mile or more of rope for these spots to come near enough together to cause any damage, and also because it is a fact, as has been demonstrated, that a test specimen with more than half of the exposed wires broken has shown a tensile strength of 90 per cent. of the original. It is undoubtedly a fact that more mistakes are made in buying a rope too large in diameter than too small for the service, and also in selecting one made of seven wires to the strand instead of 16 or 19 wires.

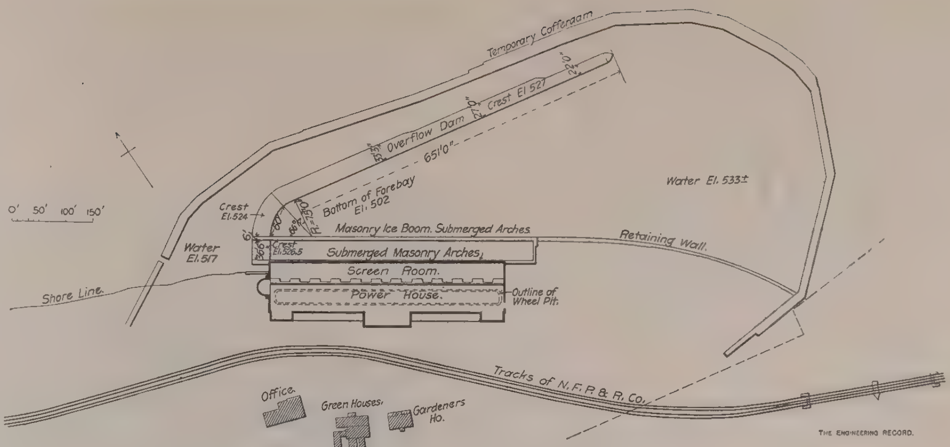
Too much cannot be said regarding the care of wire rope. It requires lubrication just the same as high-speed journals. Of course, conditions usually prevent any such treatment, but to insure the best results the rope, if made to order, should be thoroughly lubricated when the strands are being laid up into a rope; and if so treated and afterwards kept well saturated on the outside with any kind of cheap lubricant that is free from acids, good results are bound to follow. The same diligence should be exercised in looking after all sheave wheels. They should be balanced, as nearly so as is possible, bored true, with deep, wide flanges, and the grooves kept lined with Russia hemp or other fibrous material. It is not good practice to run wire rope in chilled iron grooves or even cast iron grooves, but if iron must be used, either a low steel or wrought iron lining should be specified for the grooves.

The correct way of socketing a rope is after the ends of the wires are thoroughly frayed out they are cleaned with muriatic acid and inserted in a socket, a round tapered pin, also cleaned with muriatic acid, is inserted and driven home. Then a preparation of hard solder or type metal poured in and the whole mass soldered together in such a manner that it has probably the full strength of the rope. One of those sockets has never been known to pull out.

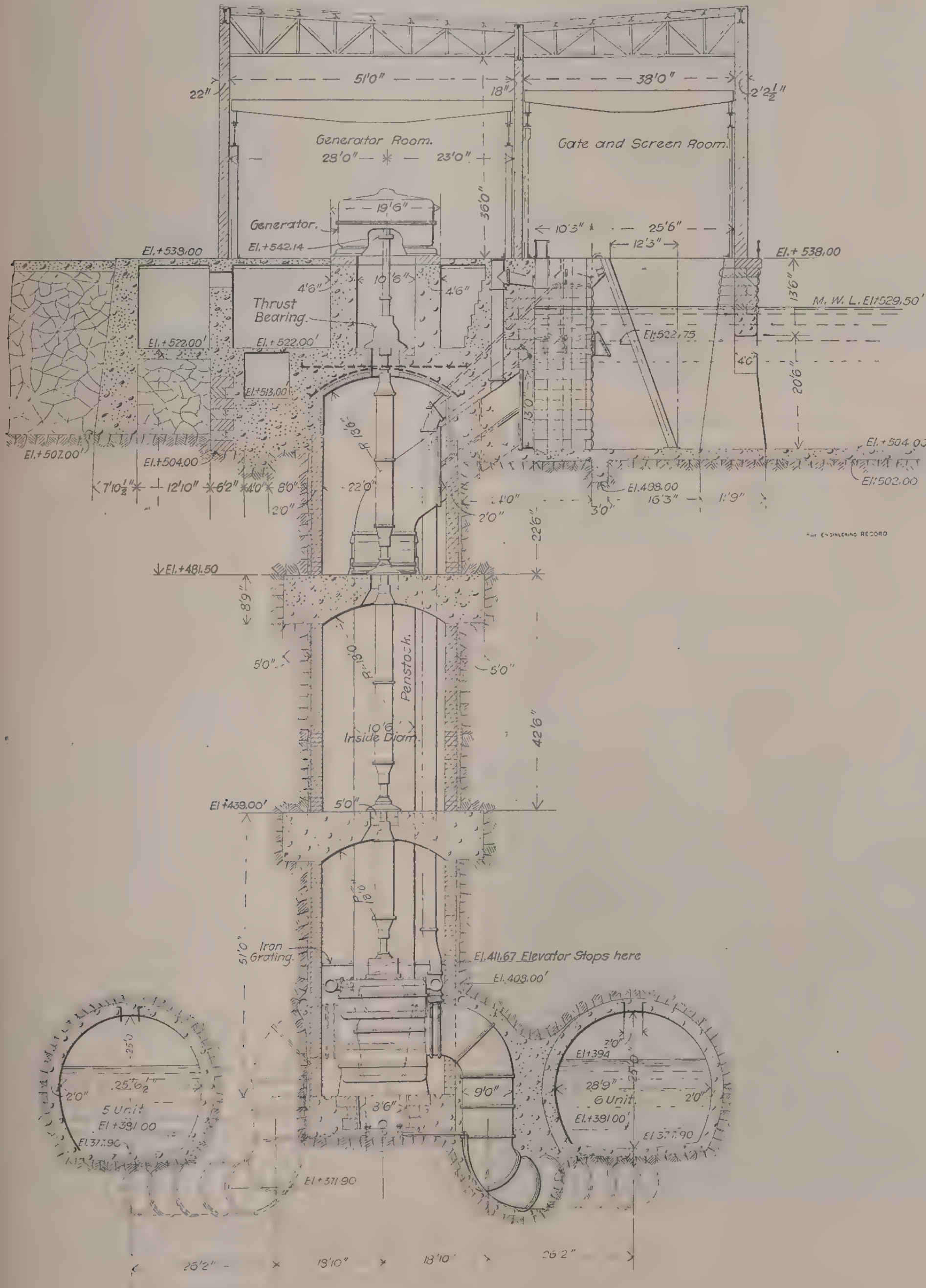
The Test of a Water-Tube Boiler that exhibited an evaporation of 7.14 lb. of water per s ft. of the boiler heating surface per hour, with rate of combustion of 71.9 lb. of coal per hour pe sq. ft. of grate, has been contributed to the Britis technical press by Mr. S. E. Fedden, general manager and engineer of the Sheffield Corporation at whose Neepsend generating station the tes was conducted. The boiler is a Stirling five-dru type having 6,210 sq. ft. of heating surface, whic was required by the specifications to evapora 30,000 lb. equivalent evaporation with coal havin 13,000 B.t.u. calorific value per pound. The gra area is 72 sq. ft., or a ratio of heating to gra surface of 86.2 to 1. The boiler is provided wi the Bennis sprinkler stoker and the air for combustion is heated by the flue gases and is suppli under induced draft. In the trial mentione which was of 8 hr. duration, a coal, which, i cluding 5.2 per cent. moisture, gave 11,887 B.t. per lb. was used. The percentage of ash a clinker was 7.72. The boiler pressure averag 196.8 lb., the steam was superheated 89° Fah and 44,356 lb. of water were evaporated per ho The equivalent evaporation was 54,096 lb., or 10. lb. per pound of coal. The average temperat of the feed water was 96.2°, that of the flue gas at the fan 480°, and that of the heated air ente ing the fire, 315°. The average percentage carbonic acid gas in the flue gases was 15.2, a the average draft at the fan suction, 2 in. The e ciency, including superheat, is given as 84.9 p cent.

Headworks of the Plant of the Toronto & Niagara Power Co., Niagara Falls.

In The Engineering Record of February 13, 1904, a general account of the scheme of the development of power from Niagara Falls as adopted by the Toronto & Niagara Power Co., on the Canadian bank of the river, was described at some length, including a somewhat detailed statement of the daring methods of construction completed at that date. Since then the work has proceeded with the headworks, and the accompanying illustrations show their general features. It will be recalled that to secure the necessary amount of water for the turbines a so-called gathering dam was comprehended in the design, this dam extending into the rapids of the river from the shore in an upstream direction.



Plan of the Headworks of the Toronto & Niagara Power Co.



Cross-Section through Power House, Wheel Pit and Tunnels.

One of the particular problems was to arrange for disposing of debris, especially of ice in winter, before these obstructing materials could reach the screens that protect the mouths of the penstocks.

The gathering dam was accordingly built with a submerged crest at El. 527, or 2.5 ft. below the mean water level, except the portion nearest the power house, where the crest was left at El. 524; and the entrance of the water to the penstocks was arranged for through a double line of submerged arches parallel with the wheelpit. The submerged arches form the foundation of a masonry wall or ice boom, in each of the two cases, for intercepting the surface currents and floating ice, while the depressed weirs of the gathering dam at the angle of the dam and the booms serve to create the direction and increased speed of surface currents for carrying away this ice. The special feature is that two such parallel booms were employed. The second or inner boom constitutes the bottom of the outer wall of the screen room, where the racks are housed, and the screen room as well as the area or bay between the booms, is open at the lower or downstream end over the spillways.

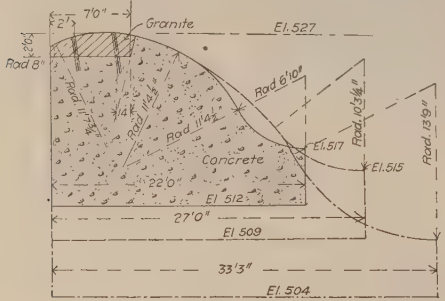
The gathering dam is of concrete, with a granite coping to resist erosion, and extends into the river at an angle of about 30 deg. with the masonry ice boom. As stated in the article referred to, it is believed that this will seize at least 1,800,000 cu. ft. of water per minute under most adverse conditions, the actual river depth proving much greater than estimated. As 700,000 cu. ft. per minute at an efficiency of 75 per cent. will supply the 125,000 h.p. for which the headworks are designed, the surplus water will thus be very large. The curves of the rollway to take care of this surplus are shown in the accompanying cross-sections, the mean height of submersion being, as stated, 2½ ft., while the maximum is placed at 5 ft., or at a water level of El. 532. The length of the straight portion of the dam is indicated, and the length of the curved section, including the part of this section which constitutes the depressed spillways can be calculate from the radius of curvature and the angle subtended.

One of the half-tone engravings is a view of the outstream face of the overflow dam, showing the concreting plant in the distance. This was in successful operation all last summer, and has a maximum capacity of about 500 cu. yd. per day. It contains under one roof a No. 5 K Gates crusher, two No. 3 1-cu. yd. Smith concrete mixers, together with belt conveyors, screens and bins. The materials were handled automatically from the time they were delivered to the plant until loaded as concrete in the iron tubs for transportation to the work.

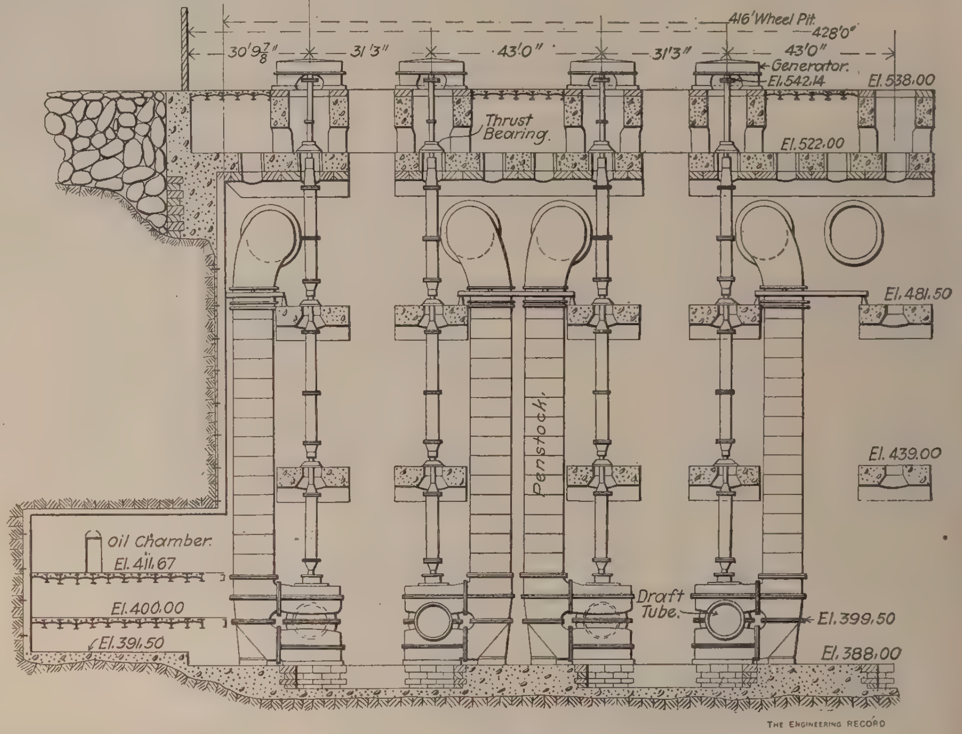
The masonry ice booms are also built of concrete except for the upper parts above the water together with the building walls above, which are all of cut stone with bush-hammered surfaces as a matter of appearance owing to the fact that the structures are within the confines of Queen Victoria Niagara Falls Park. The two booms are of similar construction, each with 23 arched openings below water level, with intermediate piers. The openings are 14.5 ft. wide and 20.5 ft. high to the crown of the semi-circular arch, leaving this crown submerged 5 ft. at mean water level. The piers are 4 ft. ¾ in. wide and 11 ft. 9 in. long at the base line, at El. 504, and the back wall of the pier has a batter of 1½ in. per foot. The thickness of the concrete work over the arch is 4 ft.

The total area of the openings in each boom is about 6,300 sq. ft., which with 700,000 cu. ft., the amount passed per minute through the inner or second boom, gives a velocity of 1.85 ft. per second. The velocity through the openings in the first boom will, of course, be slightly greater because of the spillway at the end. However, the comparatively quiet state of the water of the bottom of the outer forebay is counted on to allow submerged ice to rise to the surface. The secondary bay is provided only to separate such ice as succeeds in passing through the first set of submerged arches.

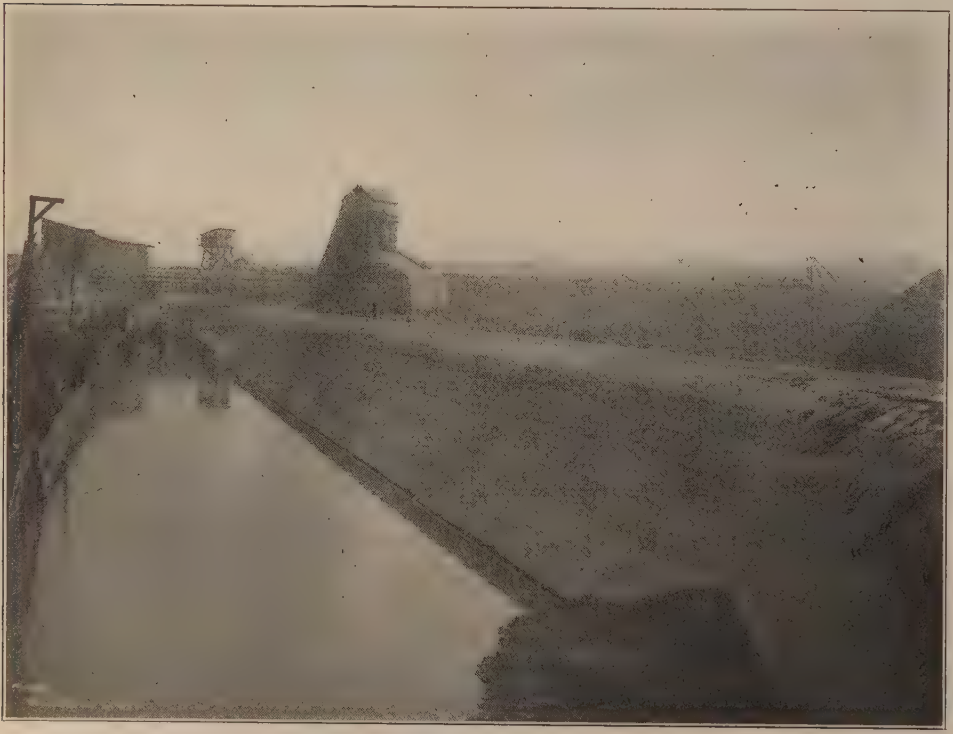
In addition to the engravings presented to indicate the character of the headworks of this development, the opportunity is taken to show also a view in one of the branch tail-race tunnels. It will be recalled that one of the particularly important features of this plant is the arrangement of a tailrace tunnel on each side of the wheelpit, resulting in a division of the plant into two practically independent portions, six of the 12,500-h.p. double turbines discharging into one tunnel and the remaining five into the other. The features of this design have, however, already been discussed in the earlier article. The present photograph illustrates the method of excavating and timbering down to the wall plate grade.



Sections of Gathering Dam.



Section through Wheel Pit Showing Four of the Eleven Units.



Down-Stream Face of the Gathering Dam, Toronto & Niagara Power Co.

The work of the development is being conducted by the Electrical Development Co., of Ontario, Ltd., of which Messrs. F. S. Pearson and Hugh L. Cooper are consulting engineers, and of which Mr. Beverly R. Value is chief engineer of construction. The foregoing data were kindly furnished by Mr. Julian Thornley, senior assistant engineer.

The Steel and Concrete Wharf at Tampico.

Reference was made in this paper on March 25 to the unusual wharf of steel and concrete recently built at Tampico by the Mexican Central Ry. Co. It replaces a creosoted pile structure which was burned soon after its completion. It is interesting to know, moreover, that the timber had been somewhat attacked by the teredo. The new wharf was designed by the late A. J. Tullock, with Mr. Alfred Noble as consulting engineer, and the following data concerning it are taken from a monograph written by Mr. E. H. Connor, chief engineer of the Missouri Valley Bridge & Iron Co.

The entire wharf is 2,600 ft. long. The main wharf is 1,200 ft. long by 75 ft. wide, and is partly covered by a steel shed 993 ft. long by 54 ft. wide. At each end of the main wharf is a lateral wharf 700 ft. long, 50 ft. wide, and 3 ft. lower than the main wharf to accommodate smaller vessels. All portions of the wharves are designed to carry a minimum live load of 800 lb. per square foot. The dead load is 200 lb. per square foot on the front portion of the main wharf, 50 ft. wide, and 150 lb. elsewhere.

A standard gauge railroad track runs the entire length near the front with turnouts on the lateral wharves connecting with tracks on ballasted creosoted timber trestle approaches from the shore. The rear portion of the main wharf, 25 ft. wide, is 4 ft. 5 in., or about the height of a car floor, lower than the front, and two standard gauge tracks run on this low portion parallel to the wharf, thus making it easy for loading or unloading cars. The floor of the Custom House back of the wharf is level with the front portion of the wharf. A push car track also runs the entire length of the main wharf, about 22 ft. from the face, with turntables for tracks running into the Custom House.

Main Wharf.—The main wharf is supported by 61 bends of four cylinders each. The cylinders in each bent are spaced 23 ft. 6 in., 23 ft. 6 in. and 19 ft. apart, respectively, from the front, and the bents 20 ft. center to center. All piers are made of steel shells with piles driven inside of same, and filled with concrete. The steel plates forming the cylinders are one-half inch thick, except in the upper 15 or 20 ft., where they are five-eighths inch thick for additional protection where the action of the elements is greatest. The cylinders in the first row, designated A, that is along the face of the wharf, are 6 ft. in diameter by about 55 ft. long. In the second or B row, 6 ft. 6 in. by 55 ft., in the third or C row, 6 ft. by 40 ft., and in the fourth or rear row, designated D, 5 ft. by 21 ft.

The cylinders were all made in sections 5 ft. long, butt jointed and riveted together. The creosoted piles extend below the cylinder shells, distances of 15 ft., 15 ft., 20 ft. and 34 ft., and above the bottom of the shells into the cylinders 27 ft., 27 ft., 16 ft. and 10 ft., respectively, in the four rows, beginning at the front. In all cases they go through silt into clean sand.

The two front rows of cylinders are braced transversely by steel cross frames about 6 ft. deep, riveted between them. The maximum loads carried by the cylinders on the caps are respectively 150, 235, 184 and 116 tons. A heavy cast-iron wall plate is partly imbedded in the concrete in the top of each cylinder to support the girders. The steel used was open hearth of medium grade, as that resists the action of salt water better than bessemer.

Rear View of Submerged Arches of Ice Boom.

Cross girders rest on the transverse rows of cylinders. These cross girders in turn support longitudinal girders, carrying the concrete floor. On account of the great shear and necessary shallow depth, each transverse girder is composed of two single plate girders, connected by diaphragms, the space between the two girders being filled with concrete. The ordinary longitudinal girders are I-beams 15 in. by 75 lb., spaced 3 ft. center to center. The girders supporting the shed columns are 24 in. by 80 lb., and those under the railroad tracks are built of one web plate 38x½ in., and four angles 6x4x½ in.

A box girder 42 in. wide by 27 in. deep runs along the face of the wharf. This is built up of solid web plates ½ in. thick, front and rear and bottom, all connected by 6x6-in. angles, and is filled with concrete. The face girder of this box girder, which also supports timber waling pieces running along the face of the wharf, is 57 in. deep, with a ½-in. web plate and four flange angles 6x6x½ in. The timber waling pieces, 12x12 in., are securely bolted by galvanized bolts and straps to the face girder in such manner that they can be easily removed. The timbers and box girder are designed to take the wear and tear and blows of vessels, lying alongside of or crowding against the wharf. This thrust is very great during high winds, as the entire wind force acting on a large vessel may bear on the wharf over a very short distance. Particular attention was given to the horizontal shear on these girders.

Corrugated iron arches to act as forms were sprung between the longitudinal beams, and the concrete floor filled in on top of same, up to the level of the tops of the beams. The minimum thickness of concrete is 10 in. at the centers of the arches. This concrete is composed of one part Portland cement, three parts sand, and five parts broken stone. The top and bottom inches are made of mortar, one part cement and one part sand. Nailing strips 6x6 in. are imbedded in the concrete about 6 ft. center to center, and the entire wharf is covered with a wearing service of plank, 4 in. thick, laid perpendicular to the face of the wharf, and fastened to the nailing strips with 8-in. lag screws.

View Showing Method of Tunneling, Toronto & Niagara Power Co.

Lateral Wharves.—These are very similar in construction to the main wharf, but are lower and only 50 ft. wide. The cylinder piers are all 6 ft. in diameter, arranged in three longitudinal rows, 19 ft. 3 in. and 19 ft. 3 in. center to center, the cylinders in each row being 20 ft. apart. The lengths of the steel shells are 53 ft., 48 ft. and 48 ft., respectively, from the face. The piles driven inside of the cylinders extend in all cases 15 ft. below them into clean sand, and project up into the cylinders 26 to 27 ft.

The steel superstructure girders, concrete floor and timbers are arranged much the same as in the main wharf, but on account of the shallower permissible depth, due to the lower elevation of the floor, the longitudinal girders frame into the cross girders instead of resting on top, and all girders are made of very heavy I-beams. The cross girders each consist of three 24-in. I-beams. The regular longitudinal stringers are 18-in. I-beams. There are no sheds on the lateral wharves.

Construction.—On account of the size of the work and the distance from well equipped machine shops, it was deemed advisable to provide a very complete equipment for this work. The following buildings were erected for construction purposes: Office building 14x40 ft., machine shop 48x144 ft., general store house 24x80 ft., cement house 18x96 ft. In the machine shop were located a low-pressure pneumatic plant for air lock-work, a high-pressure pneumatic plant for pneumatic tools, electric lighting plant, a water service pump and tools.

The wharf occupies about the same location as the burned wooden wharf, and the old piles were used for supporting staging carrying the various travelers used on the work. The piles were cut off to uniform level, capped with 12x12-in. timbers, which carried four lines of 12x12-track stringers. To these were spiked 56-lb. rails, on which the different travelers for construction purposes were operated. The staging for range D of cylinders was entirely separate from the staging used for the three front ranges. Two travelers were used in sinking the cylinders. Each was provided with two hoisting engines and three derricks, so arranged that the various operations connected with sinking could be carried on in three cylinders of a bent at the same time. The cylinder sections being brought to the bent on barges, two or three sections, according to the depth of water at place of sinking, were riveted together on the barge, then set in position, and held in place by large wooden clamps attached to the staging. The cylinders were then forced down by pull jacks, and when these were not sufficient were driven by short blows of a 1,500-lb. hammer, working in short leads, placed on top of the cylinders. The material inside of the cylinders was excavated by means of grapple dredges.

For sinking the short cylinders of the inner row, or range D of the main wharf, the plenum pneumatic process was used to avoid any movement of the sub-soil near the foundations of the Custom House, and also on account of the mass of riprap deposited along the outer edge of this foundation. For this purpose an air lock of proper size to bolt to the top of the cylinders and a small traveling derrick operating on a standard gauge track were used. The excavated material was hoisted out by a bucket attached to a wire, passing through the top of the air lock.

After the cylinders were sunk to the proper position, from ten to twelve 45-ft. creosoted piles were driven inside of each cylinder. For this purpose, a swiveling pile driver was erected. This driver was arranged so that it could be turned completely around on its center, and also arranged on a shifting or transfer table that allowed it to be transferred from one range of cylinders to another. This transfer table ran upon the same four tracks used by the sinking travelers, and followed in operation immediately behind them. The pile-driving machinery consisted of a Warrington steam hammer. A Lidgerwood hoisting engine supplied steam for operating the hammer and for the various operations of the driver in handling the pile. It was found, however, that in continuous operation, the boiler was of insufficient steaming capacity, and was therefore supplemented by a boiler from another Lidgerwood engine. To drive the piles until the butts were at the required elevation, it was necessary to use a 30-ft. oak follower, to one end of which was attached a 14-in. wrought iron pipe, ½-in. thick, and 6 ft. long, which fitted over the top of the pile.

For driving the piles in the cylinders of the inner row, or range D of the main wharf, ordinary pile leads with 2,500-lb. drop hammer were used, which pile driver traveled on rollers on skidways immediately over the tops of the cylinders. Following the pile drivers, and on the same tracks was a traveling platform used in concreting the cylinders. It was built for operation in concreting cylinders of ranges A, B, C and D of the main wharf, and consisted merely of a traveling stage gear surmounted by a 40x53-ft. platform. It was arranged and originally intended to cover two bents of cylinders, was well roofed over to keep the concrete material dry, and also to allow continuous working during rainy weather. The front part of the platform was supplied with two derricks, operated by hand winches for the special purpose of placing and removing the cylinder air locks, used in pneumatic placing of concrete. The concrete traveler was operated in this way over about 15 bents, after which it was found unessential to use the air lock in sealing the cylinders. They could be sealed sufficiently tight by placing through a tremie 1:2 mortar about 5 ft. in depth, two or three days prior to the pumping out of the cylinders. The traveling platform was therefore increased in length so as to cover three bents of cylinders, making a working platform 53 ft. square, thus allowing the sealing with mortar of one bent, the pumping out of another bent and the placing of the main body of concrete in the third bent, all operations being carried on at the same time. When the cylinders of ranges A, B, C and D of the main wharf had been completed, the concrete platform was changed to suit the gauge of tracks of the lateral wharf.

It was found that although the cylinders were excavated to the cutting edge, and usually below during the sinking operation, that after the piles had been driven in them they had refilled with sand 4 or 5 ft. Before the cylinders could be concreted it was necessary to remove this sand, which was done by use of a long 3-in. siphon worked down between the piles. As soon as the sand was cleaned out, 1:2 mortar was placed by means of a tremie in the bottom of the cylinder to a depth of 4 or 5 ft. This mortar was allowed to set about 24 hr., when it was found that the cylinders were usually completely sealed at the bottom, and could then be pumped out, and the balance of the concrete laid in the open air.

In a Surface-Condensing Unit at the municipal electric generating station of Burton-upon-Trent, England, the exhaust is passed through a grease separator before entering the condenser, and the pumping equipment is driven by a 14-h.p. Fynn repulsion induction motor. The condenser is designed to handle 13,500 lb. of steam per hour. The air pump, of the three-throw type, is driven from the motor through gearing, while the circulating pump is direct-connected to the motor.

The General Design of the Quebec Bridge.—II.

Main Vertical Posts.—The main vertical posts between the anchor and river cantilever arms are 315 ft. high, center to center of pins, and weigh about 350 tons each. Their maximum working stress is about 10,000,000 lb., and they have a 5x10-ft. cross-section made with four transverse webs, which at the upper end are resolved into twelve longitudinal webs for the pin bearing. There is a considerable extension above the top pin, thus giving the post a total height of about 350 ft. above the top of the pier. It is made in five sections of about equal length, the heaviest weighing about 80 tons. The top and bottom pins are respectively 12 in. and 24 in. in diameter, and in order to avoid handling the long, heavy post sections at the boring machines, the extremities 5 ft. wide, 10 ft. long and 10 ft. high, weighing 60 tons each, were made separate, like shoes, and will be field-riveted to the post-sections through horizontal flanges and diaphragms. The lower pin is 7 ft. long, and is bored with a 6-in. hole in the axis. It has a total length of 40 in. bearing on the webs, the thickest of which is reinforced to 13¼ in.

Vertical Post and Lower Chord in Bridge Shop Yard.

Shoe and Pedestal.—This pin connects the post with a 11½ by 13-ft. shoe, 7½ ft. high, which weighs 66 tons, and required seven months' work of an expert draughtsman to design it, and the connections to it. The pedestals and shoes are made with the largest and heaviest plates available, and their dimensions are so great that if some of the base plates had been 4 ft. longer no rolling mill in the United States could produce them, and if some of the web plates had been ¼ in. thicker no shears now built could have cut them. These pedestals were too large and too heavy for ordinary cars, and the Pennsylvania Railroad Co. has made a special steel car to transport them from the shops to the bridge site. This car is not floored; it has a massive framework of longitudinal and transverse box girders enclosing an open central space in which the pedestal is suspended from a transverse girder passed through its 24-in. pin hole, supporting it with the lower and upper sides, respectvely 6 in. and 13 ft. above the rails.

The total load imposed by each truss on each main pier is about 14,000 tons, which is distributed over 360 sq. ft. of masonry by two riveted steel grillages or bolsters inserted between the pedestal and the bridge seat. The upper bolster has ten 36x2½-in. transverse webs, and a 96x162-in. bottom plate 2 in. thick, and weighs about 25 tons. The bottom bolster has eleven 26x2½-in. longitudinal webs, with 8x6x1-in. connection angles to a base plate made with two 9 ft. by 20 ft. by 2-in. plates. The 2½-in. web plates were cut in a cold saw, and all rivet holes were drilled from the solid 1 1/16 in diameter. The pedestals are bedded on Portland cement mortar, and are secured to the masonry by anchor bolts.

Intermediate Vertical Posts.—The intermediate vertical posts are from 96 ft. to 225 ft. long, and are made in sections up to 105 ft. long, field spliced together with web and flange cover plates. They have open rectangular cross sections, made with built channels having uniformly a 48-in. web and 6x8-in. flange angles latticed by X-brace diagonal angles, no flat lattice bars being used in any member of the bridge. At the ends and center points of the posts there are wide thick flange plates projecting far beyond both sides to receive the chord pins at panel points, and the separate pins provided for the diagonal members to facilitate the erection and reduce the pin moments. The widest sheared plates used are 134 in. wide, and as 11 ft. is about the maximum clearance for members shipped on standard cars, it was adopted for the limiting dimension of the post connection plates. The diagonal members of the cantilever trusses are made in two lengths, and the eyebars of each length have a separate pin connection to the middle part of the vertical post. These pin holes must obviously be located with precision in relation to themselves, and the top and bottom chord pin holes. The center lines are laid out on both sides of the connection plates, one of the pin holes is bored, and a cast-iron template is clamped to the post. The post is set on the table of a machine with two horizontal counter boring bars having ball-bearing rests; they are adjusted to fit the template, and the holes are bored with absolute accuracy. A clearance of 1/32 in. is allowed between pin and pin hole at each main panel point connection.

Floorbeam and Strut at Anchorage Pier

Bottom Chords.—The bottom chords have a rectangular cross section 4 ft. 6 in. deep, and 5 ft. 7½ in. wide, made with four built channels each having a 54-in. reinforced web and 8x3½ or 8x6-in. flange angles 1 in. thick, latticed top and bottom with simple transverse angles dividing the space into square panels, each X-braced by single diagonal angles, one of which has its vertical flange cut to clear the other, which is made continuous. At panel points the flanges are covered by wide tie plates, which project to form jaws receiving the bottom lateral struts. The chords change direction at panel points to conform to the parabolic curves of the trusses, and are spliced there with shop-riveted web and flange cover plates. In order to facilitate shipment and erection there is a second field-riveted splice made 10½ ft. beyond each panel point, counting from the main post. The chord sections have a maximum length and sectional area of 68 ft. and 842 sq. in., respectively, and the heaviest one weighs 100 tons, thus becoming the heaviest piece in the bridge. Each field splice has from 500 to 750 1-in. rivets, all driven by pneumatic hammers.

Before the commencement of shop work, the template makers built a full size wooden model, 20 ft. high, of all members and connections at the typical panel point L2. This shows every plate, angle and rivet there, gives clearances and dimensions and illustrates the scale and character of the construction in a graphic and satisfactory manner that is considered by the contractors to amply justify its cost of about $500.

Here as well as in the drawings and finished members the symmetry of the reinforcement plates and careful finish and neat arrangement of the rivets in geometrical patterns is evident and pleasing. The plates are centered on the construction lines, their ends are neatly beveled, and all edges between adjacent divergent members are curved.

Eye-bars.—This bridge contains about 2,500 eyebars weighing in all about 7,500 tons, with maximum dimensions of 15 and 16 in. wide, 1⅜ to 2⅛ in. thick, and a length of 76 ft. over all. The lengths of the bars were determined by the maximum dimensions of 15x2 in.x85 ft., which could be rolled at the mill, and the thicknesses by the opposing difficulties of testing thick bars and of forging very thin heads. The heads of the bars were proportioned with an excess of about 40 per cent. over the metal in the body. The fact that the upsetting machine could not make heads more than 32 in. wide determined the use of 15-in. bars and 12-in. pins. Afterwards it was found practicable to increase the width of the heads to 36 in., and use 16-in. bars and 14-in. pins. The eyebars are manufactured in the regular die-forging plant, upset by an hydraulic machine with three heats and forged with three heats by a 6-ton steam hammer, at the rate of 24 heads in 10 hours. Great care is taken to set them in the boring mill at exactly the same angle to the boring bar that they will make in the finished structure with the pins, thus providing square full bearings corresponding to the slight divergence in distance allowed between the bars at opposite ends to conform to packing requirements.

It is required that 2 per cent. of all eyebars be tested to destruction and break in the body, and this result has been satisfactorily secured on all of the twelve bars thus far tested, which have developed an ultimate strength and elastic limit of about 57,000 lb. and 32,000 lb., respectively. The bars are broken in a hydraulic plunger direct-action machine of 2,250,000 lb. capacity, which can receive a 16x2-in. bar 50 ft. long, and usually breaks it in about 15 minutes after commencing to apply the strain. The bars elongate about 5 ft., and the 12-in. pin holes to as much as 14¼ in.

The eyebar packing was found to be a very difficult problem, and to adjust it satisfactorily for one anchor arm required the time of one skilled designer for seven weeks. He succeeded in reducing the unit bending stresses in the pins from 24,000 lb. to less than 20,000 lb. per sq. in. All designs, calculations and details have been worked out by the regular engineering force of the Phœnix Bridge Co., all materials, except heavy plates and pins, have been rolled by the Phœnix Iron Co., and all the superstructure will be built by the regular plant of the Phœnix Bridge Works, and erected by the regular and special erection plant in charge of the regular corps of Phœnix shop and field staff, facts in which the contractors take special pride. About 16 men have been engaged 8 months on the design and shop drawings of the anchor arm trusses, and the shop work is considered equivalent to about one year's capacity of the plant; but as not more than one-fourth of it will be underway at any given time it will not interfere with other contracts.

Where the lower chord is at nearly the same elevation as the rail base, the floorbeams are simple plate girders, 10¼ ft. deep, 64 ft. long, and weigh about 30 tons each. They are made of 8x6-in. flange angles and webs 7/16 in. thick notched at the ends to clear the lower-chord pins. Where the lower chords diverge materially from the lines of the rails, the floorbeams are lattice girders having variable depths corresponding to the panels of the sway-bracing, the diagonal members of which are utilized as members of triangular floorbeam trusses with a maximum depth of 50 ft. There are four lines of plate girder railroad track stringers 58 in. deep, and eight lines of 38-in. stringers for the trolley tracks and highway floor. The track stringers are braced by zig-zag horizontal angles, but no other lateral system is provided for the trolley and highway than is furnished by the transverse joists, notched and bolted to the stringer flanges and the 3-in. plank deck.

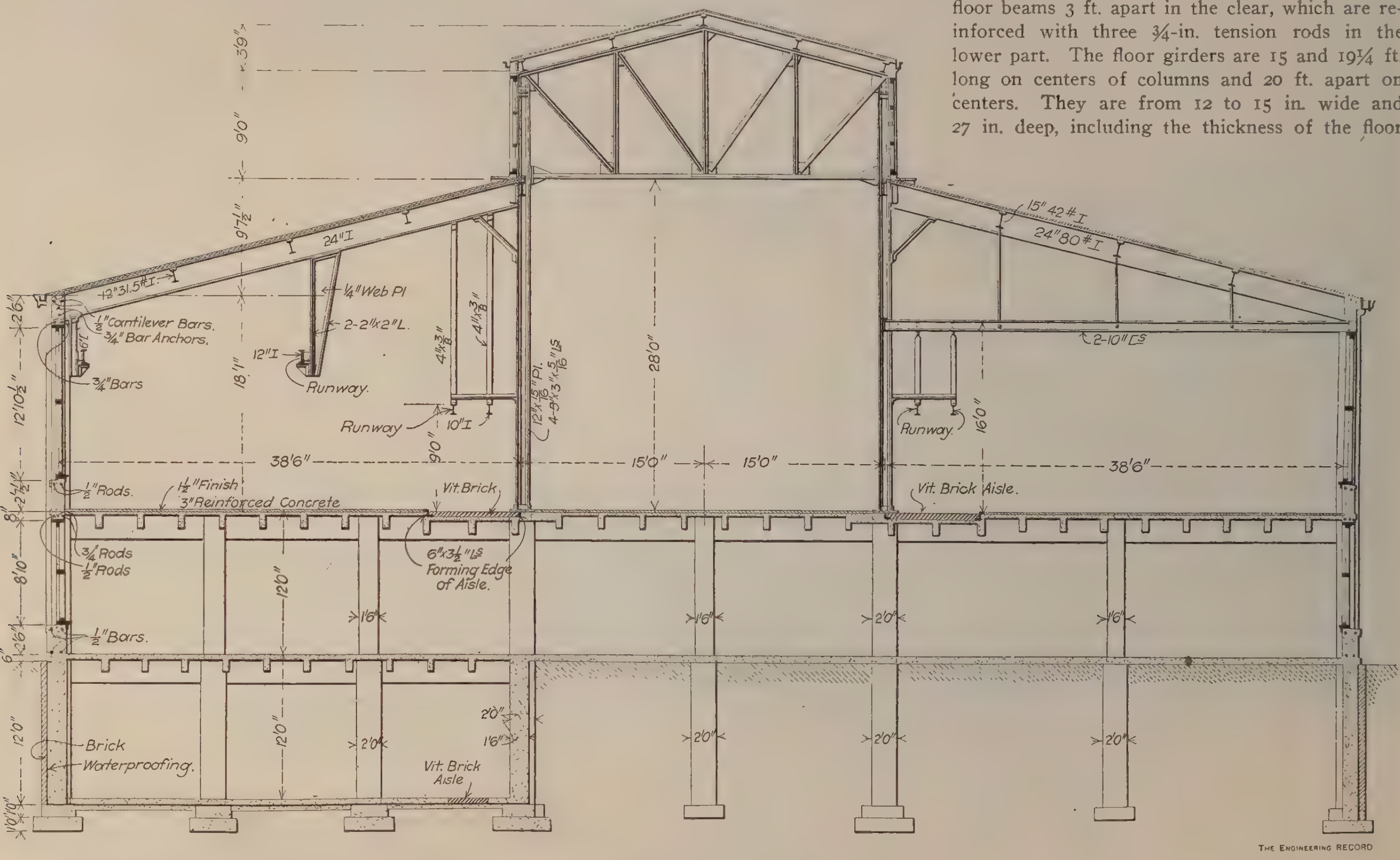
Nearly all of the shop work is executed with the plant previously installed for ordinary work, but this has been somewhat augmented by a few extensions and additions among which the principal items are; one double rotary planer with heads 64 in. in diameter driven by 25-h.p. electric motor, one 10x10x25 ft. planer, driven by 35-h.p. electric motor. The eyebar upsetter has been remodeled and the eyebar shop has been rebuilt, extended and equipped with 2 electric cranes of 60-ft. span and 15,000 lb. capacity built by The Phœnix Iron Co., and operated by 2 electric motors, each of 25 h.p., built by the General Electric Co. The storage and shipping yard has been extended, and in it there has been installed a 75-ton girder crane of 90-ft. span, operated by two 50-h.p. motors made by the General Electric Co.

The very heavy large plates for this bridge are rolled by the Central Iron & Steel Co., Harrisburg, Pa., and by the Carnegie Steel Co., and pins from 12 to 24 in. in diameter are forged by the Bethlehem Steel Co.

Mr. E. A. Hoare is chief engineer and Mr. Theodore Cooper consulting engineer. The contractor for the steel work and erection is the Phœnix Bridge Co.—Mr. David Reeves, president; Mr. John Sterling Deans, chief engineer; Mr. P. I. Szlapka, designing engineer, and Mr. A. B. Milliken, superintendent of erection. All of the designs, calculations, details, estimates and quantities are approved in the office of the consulting engineer, Mr. Bernt Berger, chief of staff, and the detail designs at the works have been in charge of Mr. C. Scheider.

The Shops of the United Shoe Machinery Co., Beverly, Mass.—II.

Foundry.—The 108-ft. 10-in. by 221-ft. 10-in. foundry is a two-story building of reinforced concrete, except the roof and two interior rows of second-story columns which are steel. The rows of columns divide the building into a 30-ft. center and two 38½-ft. side longitudinal aisles, both of the latter being equipped with traveling cranes supported from the roof, as indicated in the general cross-section. The footings for the walls and columns are carried down to a depth of 13½ ft. below finished grade, and the first floor is laid on the level surface of the ground, except in the west side where there is a basement 12 ft. deep below the first-floor level. The exterior faces of the side walls are divided into 20-ft. panels by the pilasters or wall piers which support the ends of the rafters over the side aisles and are connected by two horizontal concrete belt courses or longitudinal girders at the second-story level and at the eaves, thus dividing the panels into upper and lower rectangles about 13 and 9 ft. in height, respectively. Each of these rectangles has two double-sash windows occupying the entire space, except for the narrow vertical strip of concrete which separates them. The clere-story on the sides of the center aisle has corresponding panels 10 ft. high formed by the upper ends of the main columns and each of them contains four full-height windows occupying the entire space. There is a hipped skylight 60 ft. long on top of the monitor in the center of the building and in it and in the monitor roof at both ends there are several circular ventilators.



Cross-Section of Foundry, United Shoe Machinery Co., Beverly, Mass.

The gable walls are paneled and glazed to correspond with the side walls, and the space above the eaves is divided into two horizontal tiers of windows covering practically all of the space except the triangular area above the eaves of the monitor, which is filled with concrete. The steel purlins are sheathed with 2-in. planks covered with the standard composition roofing and pitched to galvanized iron zinc gutters at the eaves. The foundation walls are generally 18 in. thick, waterproofed outside with 4-ply tar and felt covered with 4 in. of a protecting brick face. The footings are ordinarily 12 in. thick and 28 in. wide, and neither they nor the walls are reinforced.

The basement floor is about 10 ft. below groundwater line and is composed of concrete having a total thickness of 10 in. and laid in two courses, the lower one being 4 in. thick and covered with asphalt waterproofing continuous with that on the outer walls. It was assumed that the floor might have to resist an upward hydrostatic pressure due to a considerable head of ground water, and it was, therefore, reinforced by two crossed tiers of horizontal twisted steel rods. In some places the floor is laid on the leveled earth and in other places on rock. In the latter case 3-in. holes 10 ft. apart were drilled to a depth of 3 ft. in the rock and in each of them was set a pair of ½-in. vertical U-bars with their loops engaging the upper tier of reinforced rods to anchor them. The U-bars were secured by grouting the spaces around them in the holes.

The basement walls were finished flush with the top of the first floor and on them were seated the pilasters and the concrete belt courses under the first-story window-sills. These and the two upper belt courses were each reinforced with two ½-in. rods in the upper and two ½-in. rods in the lower edge to give them additional tensile strength to resist flexure. The wall piers have T-shaped cross-sections and are each reinforced in each exterior corner by a ⅜-in. vertical bar reaching to the eaves and made in one-story lengths overlapping each other and spliced with coil sleeves. The column piers shown in the general cross-section have rectangular cross-sections and are made without reinforcement. The concrete mullions in the center of each window panel are 5 in. thick and 8½ in. wide and are reinforced with four ¼-in. vertical rods extending through the full length and projecting 4 in. into the belt courses at the top and bottom. The top of the upper belt course is moulded on the outer face to give a cornice effect and is finished with a wooden moulding which is supported on a concrete fillet and receives the ends of the roof boards, which are nailed to a bearing strip embedded in the upper surface of the concrete.

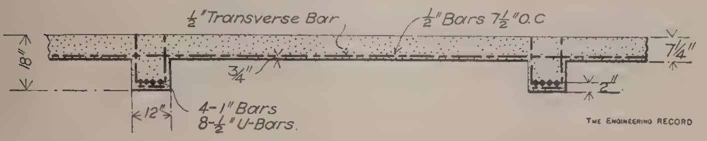
The first floor of the building at the ground level is divided by longitudinal and transverse partitions, and contains offices, locker and toilet rooms, lavatory and rooms for cleaning, pickling, flask repairs and pattern storage. The cleaning room is 120 ft. long and 38½ ft. wide and is fitted with two longitudinal overhead trolley hoists. The second floor is used for moulding and casting, and is unobstructed by partitions. It is proportioned for a live load of 200 lb. per square foot and has a 6-in. floor slab reinforced by ½-in. bars 9 in. apart carried in the regular panels on 5x15-in. floor beams 3 ft. apart in the clear, which are reinforced with three ¾-in. tension rods in the lower part. The floor girders are 15 and 19¼ ft. long on centers of columns and 20 ft. apart on centers. They are from 12 to 15 in. wide and 27 in. deep, including the thickness of the floor slab, and are reinforced by two ¾-in. upper bars in the upper edge and four 1-in. bars in the lower edge. Special floor construction is required in the cupola room and in various other places.

A peculiarity of this floor is the arrangement of two longitudinal paths 8 ft. wide which run from end to end of the building just outside of the center-aisle columns and are connected by two transverse paths 6 ft. wide and 9 ft. apart in the clear at the center of the building. These paths are depressed 6 in. below the surface of the floor and are filled with sand. The charging floor in the cupola room is proportioned for a distributed live load of 500 lb. per square foot and is built with a 4-in. floor slab reinforced by ¼-in. bars 6 in. apart on centers and supported on 6x23-in. beams 3 ft. apart, reinforced with one ¾-in. top bar and two 1-in. bottom bars. The girders, 19 ft. apart, are 16 in. wide and 32 in. deep, including the thickness of the floor slab, and are reinforced by one ¾-in. bar in the upper part and three 2-in. bars in the lower part. The special girder, 40 ft.

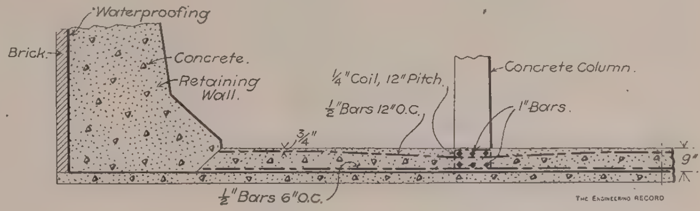
long, which carries the front edge of the platform, is 18 in. wide and 6 ft. deep and is reinforced with four 1½-in. bars in the lower edge. The finished floor is paved with vitrified brick.

Power-house.—The 91¾x98¾-ft. power house is a one-story building with a flat roof pitched slightly in both directions from the center longitudinal line. The side walls are 41 ft. high above grade and are divided by the T-shaped piers into panels 10 ft. 9⅓ in. long on centers. Each panel is open, except for the solid wall at the bottom, which rises about 2 ft. above grade, and for the cornice course 5½ ft. deep and two horizontal belt courses at intermediate points, which divide it into three spaces glazed with fixed and sliding sash, thus covering 60 or 70 per cent. of the wall surface.

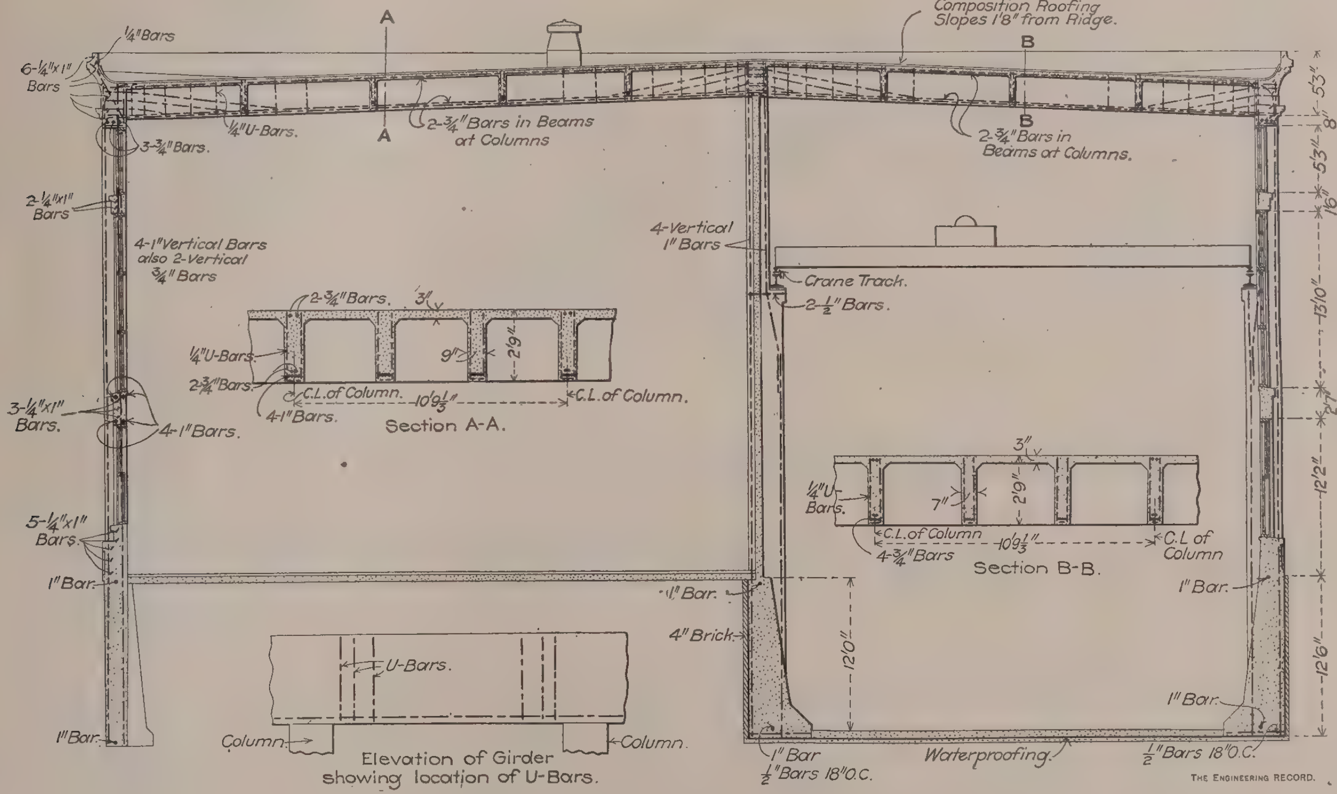
The building is divided by a longitudinal partition wall parallel to the center line, which separates it into a boiler room with its floor at grade and an engine room with the floor 12 ft. lower.



Longitudinal Part Section of Power House Floor.



Section of Power House Reinforced Floor.



Cross-Section of Power House, United Shoe Machinery Co.

The foundations of all the walls are carried down below the engine-room floor, where they have extended monolithic footings but are not reinforced. At the columns they are provided with buttresses to distribute the concentrated loads. Each column or wall pier is reinforced. The partition wall is only 6 in. thick above the boiler-room floor, but is made integral with the columns in the transverse planes of the wall piers, which project like pilasters beyond both faces of the wall and carry the roof girders. Each of these columns as well as the wall piers is reinforced by four ½-in. vertical bars, each made in two or more lengths lapped 32 in. and spliced with coiled couplings so as to be continuous from the footing to the roof.

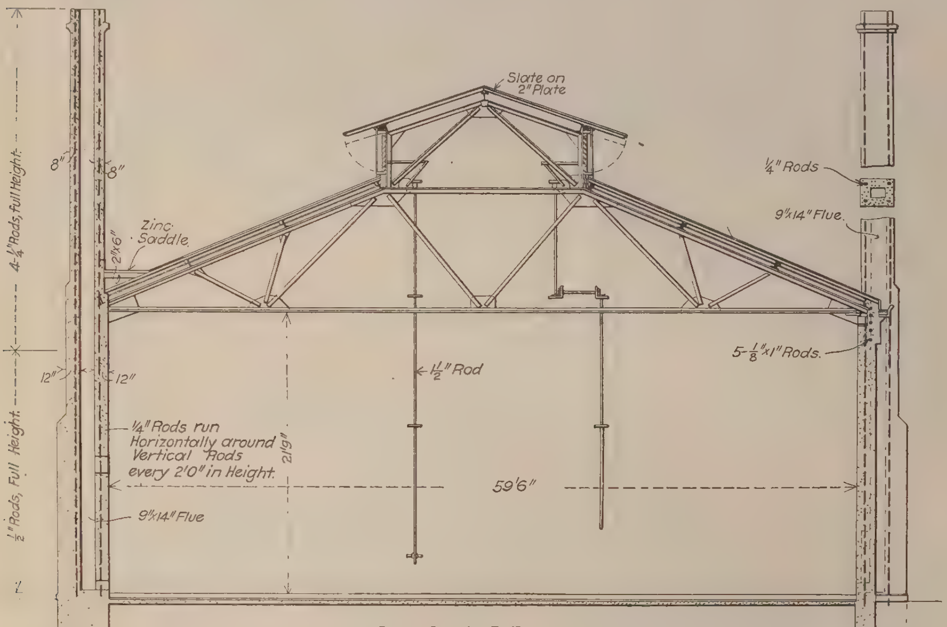
The foundation walls are reinforced with a single 1-in. bar in the upper and lower edge, and both of the horizontal belt courses are reinforced with 1-in. bars, as indicated in the cross-section, which are made continuous around the building by 32-in. laps and coil splices at the joints, thus strengthening the belt courses against flexure. These courses are also similarly reinforced with 1x¼-in. bars lapped 18 in. at joints and bedded in the concrete 4 in. from the exterior face. They are twisted with a pitch of 6 in. Similar flat twisted bars are also embedded in the faces of the cornice course and in the wall between the lower window-sills and grade. The cornice is further reinforced by inclined ¼-in. bars 2 ft. apart on centers which reach from the upper edge diagonally across to the lower edge. In the engine room the pilasters of the wall and interior columns are carried up to a height of about 20 ft. above grade, where they terminate and form seats for the steel track girders of a 10-ton traveling crane. The tops of the interior columns are connected by a 21x36-in. longitudinal ridge girder reinforced with two 1-in. bars in the lower edge.

The 3-in. roof slab is made without reinforcement and is integral with the inclined transverse girders about 2 ft. 9 in. apart in the clear which support it. These girders are carried directly on the columns at panel points and by the ridge girder and cornice girders at the intermediate points. They have a uniform cross-section 9 in. wide and 2½ ft. deep, exclusive of the thickness of the roof slab. At panel points they are reinforced by four 1-in. bars in the lower edge which are bent upwards at the ends, as indicated in the cross-section and overlap each other in the ridge girder. There are also two ¾-in. straight bars placed just above them in the lower part of the beam and two ¾-in. straight bars in the upper part of the beam. All of these bars are lapped 24 in. over the center column and are spliced with coil couplings. The intermediate transverse beams each have four 1-in. bent bars in the lower edge, but are made without the ¾-in. bars mentioned in the other beams. The beams are braced longitudinally by struts 3 in. wide and 30 in. deep, which are reinforced by single ½-in. bars in the lower edge and connect their webs at intervals of about 10 ft. All of these beams and struts were made simultaneously so that they form homogeneous masses at intersections. The roof is covered with the usual felt, asphalt and gravel composition.

As the floor in the engine room is 10 ft. below maximum ground-water level, it was reinforced against upward hydrostatic pressure by means of an upper and a lower tier of ½-in. twisted bars 12 in. and 6 in. apart on centers, respectively, with their extremities bonded into the footings of the side walls. The first floor in this room is carried on two longitudinal rows of concrete columns seated on the basement floor. Underneath each line of columns the floor is reinforced by six 1-in. bars, lapped 33 in. at joints and spliced with coil couplings so as to make continuous longitudinal girders resisting the upward pressure on the floor panels. The first floor is made with continuous slabs 7¼ in. thick, reinforced by ½-in. bars 7½ in. apart on centers and supported by transverse beams 12 in. wide and 18 in. deep, including the thickness of the floor slab. These beams are about 10¾ ft. apart on centers and are reinforced by four 1-in. bars in the lower edge. The columns supporting the beams intermediately are 12 in.

square and are each reinforced with four ½-in. vertical bars. Around the stair well and elsewhere are special beams and girders.

Forge Shop.—The 61-ft. 10-in. by 196-ft. forge shop is practically an extension of the storage buildings and with it and the connecting lavatories occupies a space equal and symmetrical with those of the machine shops. It is a one-story building about 40 ft. in extreme height and has a concrete floor and walls and a slate roof carried on riveted-steel trusses spaced 16 ft. apart. The walls are about 30 ft. high from grade to eaves, and are paneled by pilasters 16 ft. apart on centers serving as seats to support the roof trusses. Some of these pilasters are hollow and serve as chimneys for the forges. In every other panel the pilasters are carried up 23 ft. above the eaves and finished with a top moulding. At the intermediate panels they are capped just below the eaves, but remain available for future extension when required. Each chimney is reinforced by one full-length ½-in. rod in each corner. The panels between the pilasters have curtain walls of concrete pierced for wide windows with arch tops which occupy three-quarters of the entire surface. They are reinforced by two ½-in. vertical rods under the bearing for each roof truss and by five 1x½-in. horizontal flat bars embedded in the cornice course.



Cross-Section of Forge Shop

The Engineering Record.

The floor of the building is of concrete laid in two 6-in. courses with waterproofing between. The riveted steel roof trusses are anchor-bolted to the concrete walls and carry 2-in. channel purlins with nailing strips to receive the wood sheathing and slate roof. The sides of the monitor are fitted with solid sheet metal shutters in a wooden frame hinged at the top so that the bottom may be revolved upwards for ventilating purposes by means of toggle links operated by gears commanded from the first floor by vertical rods as indicated in the cross-section.

Chimneys.—In addition to the chimneys built in the side walls of the building there is a reinforced concrete stack 77 ft. 10 in. in height from the bottom of the footing and tapering from 9 ft. 3 in. x 10 ft. at the base to about 7 x 6 ft. at the top where it is finished with an ornamental moulding. It is divided into two portions by an interior concrete diaphragm reinforced by horizontal ¼-in. bars 18 in. apart and up to a height of 25 ft. above the footing. One side of the chimney is again subdivided by a longitudinal diaphragm, making two flues, one of which is used for furnaces and the other for induced draft. The upper 45 ft. of the chimney is unlined; below that the chimney is lined with fire brick. The walls of the chimney have a thickness varying from 18 in. at the base to 9 in. at the top and are reinforced by six vertical ½-in. bars lapped 18 in. at the joints and spliced to be continuous from the base to summit. The bars are connected by ¼-in. horizontal bars bent to make rectangular frames 1 in. from the outer surface of the concrete and 12 in. apart vertically for the full height of the chimney. The concrete foundation is about 6½ ft. deep and is stepped off to a 13 x 14-ft. base.

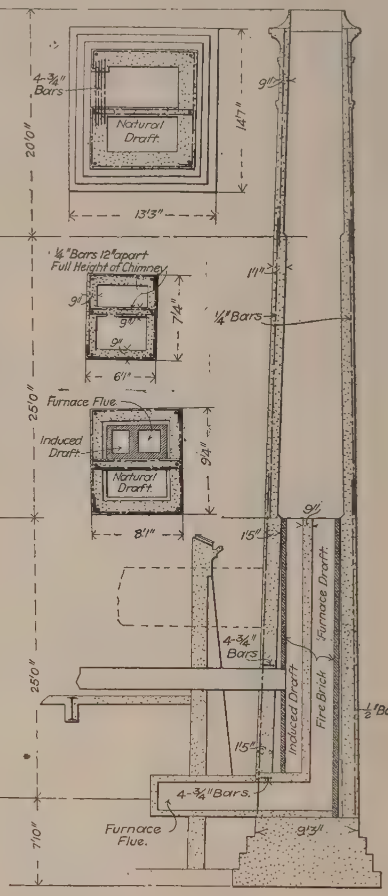
The power house has a reinforced concrete stack 142 ft. high and 6 ft. in diameter inside. The base is 18 ft. square, 1 ft. 6 in. thick at the edges and 3 ft. 6 in. thick under the stack, and is reinforced in accordance with the Weber system described in this journal on May 21, 1904. A more detailed description will be given later, explaining the calculations of the structure. From this base to a height of about 60½ ft. the stack is 8 ft. 4 in. in diameter. The base and the bottom 12½ ft. are embedded in the ground. This portion has a 6-in. outer and a 4-in. inner shell, with a 4-in. air gap. The upper part of the stack is a single 5-in. shell. The reinforcement consists of 1¼x1¼x 3/16-in. vertical bars and 1x1x½-in. horizontal bars, all of T-section. The lower portion of the stack has 72 vertical bars and the top 12 of them, the intermediate vertical reinforcement being varied between these limits according to the elevation. The horizontal bars in the inner shell are 1½ ft. apart. In the outer shell and in the upper part of the stack where there is only a single shell, they are 3 ft. apart.

Work on this chimney was begun on September 26 and the last forms were removed on November 5. The mixing and hoisting were done by a combination machine designed by Mr. Carl Weber, president of the Weber Steel-Concrete Chimney Co., of Chicago, which designed and built the stack. The concrete was a mixture of 1 part Iroquois Portland cement and 3 parts sharp bank sand. No outside scaffolding was employed, all work being done from the inside of the chimney with the aid of a light ladder.

The architect of these buildings was Mr. F. M. Andrews, of Dayton, Ohio, and the general contractor was The Fosburgh Co., of Boston, Mass. Mr. E. L. Ransome, of New York, was the consulting engineer for the reinforced concrete construction, and Messrs. Dean & Main were the consulting engineers for the power plant. Mr. D. J. Andrew is the superintendent of the United Shoe Machinery Co. which owns the works.

Cement Covered Wood Poles.

Cement covered wood poles have been employed by the Zurich electricity works, according to Mr. M. Kastler, in the "Schweizerische Elektrotechnische Zeitschrift." The pole is first surrounded by a wire netting supported from the pole by suitable iron brackets and iron bars and it is then covered with 1½ to 2 in. of cement. Poles of 39, 42½ and 46 ft. length have been used. Before adoption tests were made on a pole 39 ft. 4 in. long, and 7.9 in. in diameter at the top and 12.4 in. at the bottom. Some 5 ft. 3 in. were imbedded in the ground and the pole was subjected to a pull at a point 33 ft. 5 in. above the ground, the force being gradually increased until the pole broke. This took place when the pull reached 2,370 lb. and it was observed that the deflections remained very nearly proportional to the force applied. For a force of 1,860 lb., for instance, the deflection was 2 ft. 11 in. It is stated that the poles have proved satisfactory for the three years they have been in service.



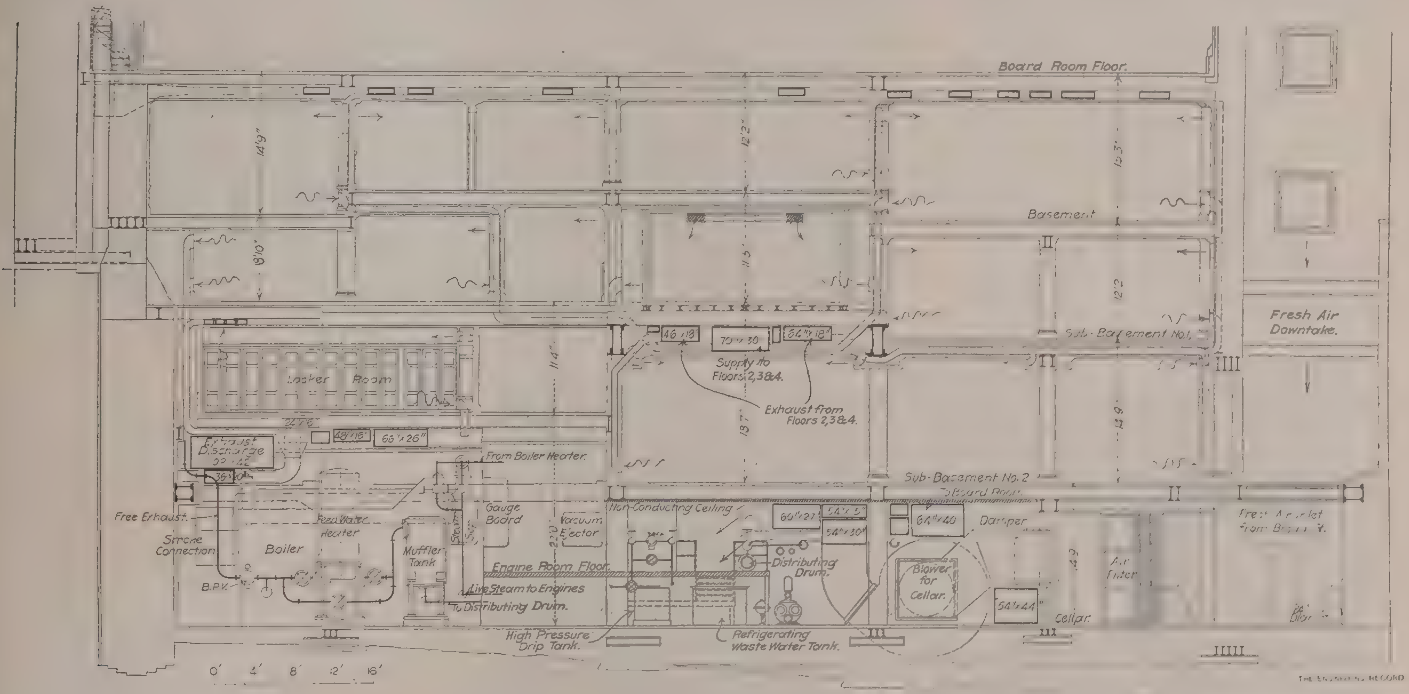
Forge Shop Chimney.

The Engineering Record

Damage from Percolation from a reservoir was recently established by the New York Supreme Court, Appellate Division, in Schwarzenbach v. Electric Water Power Co., of Oneonta, 92 N. Y. Sup. 187. The company bought the right to flood 2.07 acres of Schwarzenbach's land by erecting a dam on his property. When this was done water percolated from the reservoir so as to flood about as much more land, rendering it untillable, and interfering with his fertilizer business conducted nearby. The court rules that the percolation was unlawful and a continuing trespass on Schwarzenbach's property, for which he was entitled to damages and an injunction.

Heating, Ventilating and Air Cooling at the New York Stock Exchange.—I.

The new building of the New York Stock Exchange, besides being conspicuous as the central home of American finance and one of the architectural adornments of the city, contains an engineering equipment of exceptional interest. Heating is done by direct radiation, but some of its requirements are of a special character, owing to the necessity of warming the large board or trading room, which has a volume of 1,200,000 cu. ft. and two expanses of exposed glass walls, each 92x51 ft. in area. Ventilation is afforded by the usual mechanical means, but the apparatus is of an extensive character and of large proportions, with particular interest attaching to the details of the air distribution through the board room. The air-cooling system, however, is the most important feature of the mechanical installation, as it marks the introduction of a provision for comfort during hot weather that is the leading example of its kind in existence both from its magnitude and the exacting conditions of its service.



Vertical Section through Underground Rooms of the Building.

While there are some 13,000 sq. ft. of direct radiation, 8,170 sq. ft. of tempering coil surface and about 500 sq. ft. of supplementary indirect heating surface in the heating system, and eleven fans circulating about 225,000 cu. ft. of air per minute through some 2,675,000 cu. ft. of space in the ventilating system, the figure indicative of relative magnitude relates to the refrigerating plant, which, for cooling the air, delivered at a generous per capita rate to both the underground rooms and the board room, is of 450 tons' refrigerating capacity. It is intended, in the present study of the building, to discuss these plants at some length, but before so doing to describe the working plant in the cellar. The building was erected from the plans of Mr. George B. Post, of New York, and Mr. Alfred R. Wolff, of that city, was the consulting mechanical engineer and designer of the plant.

The building extends from Broad to New St., with a wing reaching to Wall St. In constructing its foundations caissons were sunk 54 ft. below the New St. curb or 42 ft. below ground water level, forming a cofferdam of concrete entirely around the site. It was decided to excavate the space so enclosed and to arrange for underground stories therein, largely for office occupation, except the lowest, which was reserved for the mechanical plant. There are accordingly above the cellar two sub-basements, Nos. 2 and 1, and the basement, the last only partly below street level. The location of the offices underground emphasized the value of providing cool air during summer, the importance of the idea for the comfort of the board room always having been realized.

The board-room floor is immediately above the basement, and above this, corresponding to the 86 ft. gross height of the room, are a gallery floor and four mezzanine floors, in the portion of the building at either end of the room. The next two floors are known as the bond and club-room floors, respectively, taking their names from the principal rooms in each case. Above the latter is the attic, and this, with the janitor's apartments on the roof, complete a total of fourteen stories from the cellar bottom upward.

The Mechanical Plant.—The arrangement of the mechanical plant, of which a plan is shown herewith, is in brief as follows: The location of the fresh-air shaft for the ventilating system, at one side of the building, resulted in reserving the larger part of that side of the cellar for the air filters and the blower units. The necessity for a relatively lofty space for the apparatus of the refrigerating plant determined its position along the New St. or rear wall of the cellar, where it rises through both the cellar and sub-basement No. 2. It was decided to place the boiler and electric-generating plants on the opposite side of the cellar from that occupied by the ventilating system, with the boilers toward the front or Broad St. end, and immediately under the shaft for the smoke flue. This left space in front of the ventilating apparatus, extending along the Broad St. wall, and a somewhat long and narrow space between the ventilating machinery and the boiler and engine rooms, in both of which spaces the rest of the plant is distributed. The elevator pumps were set along the boiler-room wall, and the house and fire pumps, the water filters, the sewage lifts, an auxiliary electric-generating unit and the compressor and tanks for the pneumatic tube service were distributed in the remainder of this space. The boiler-feed and other pumps, together with the ventilating blowers, were arranged along the area extending from the equipment just enumerated to the refrigerating room.

The boiler and engine rooms are partitioned off from the rest of the cellar, and at the front end of the former is a 150-ton coal bunker, directly underneath chutes dropping from street level. Alongside the engine room, between it and the adjacent building wall, a storage battery has been installed, and also one of the elevator pressure tanks for the elevators nearby.

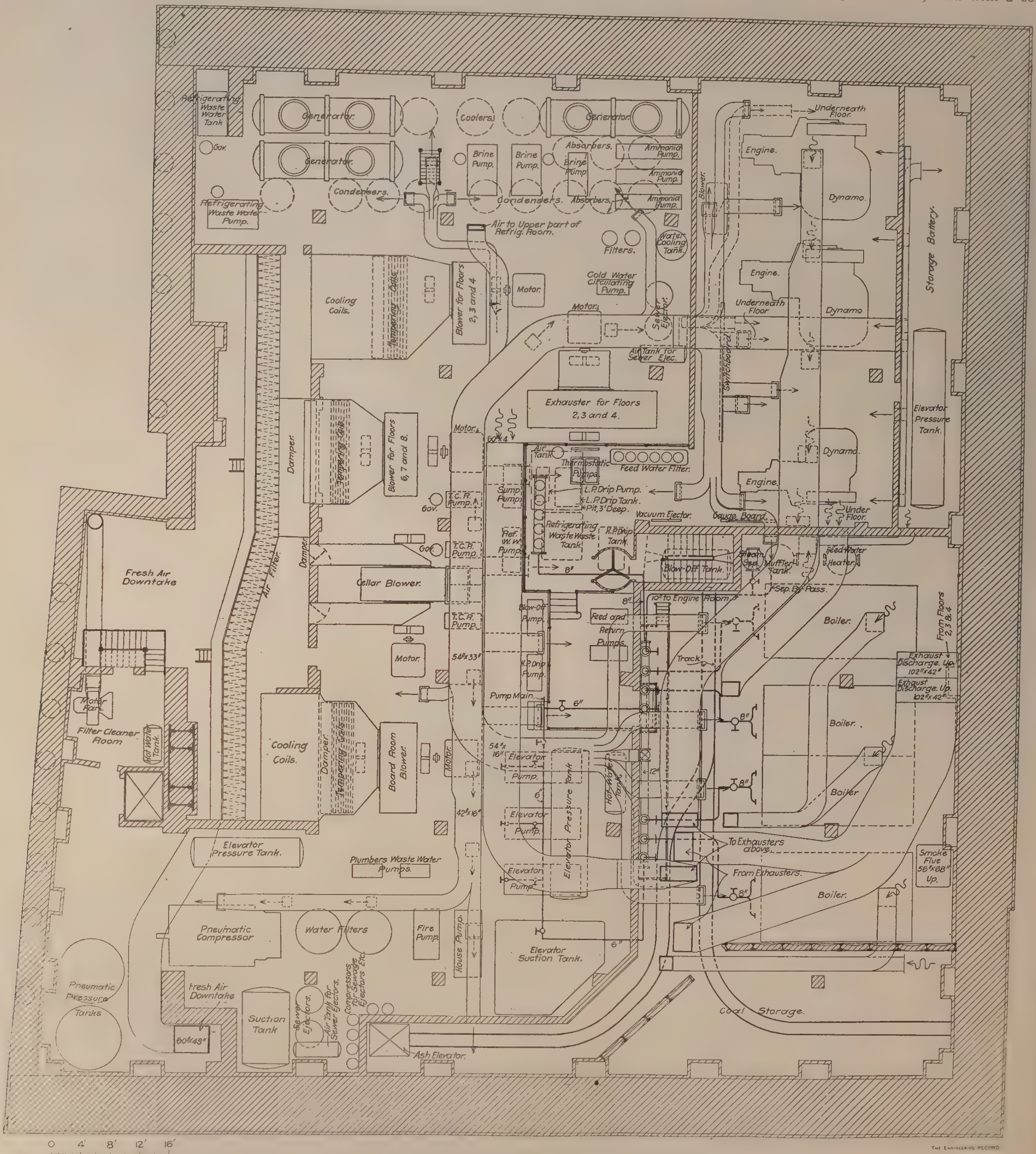
A feature unusual in building plants of this description is the elevation of the engine-room floor above the general cellar bottom, an arrangement which provided a 5-ft. space for running the steam, exhaust and other pipes. The elevated floor was partly the result of erecting the generating-unit foundations upon the concrete floor existing over the entire building site. In order to get additional headroom in the engine room, however, the extensive locker room, required for the boys employed in the Stock Exchange, was located in the sub-basement No. 2, immediately above both the engine and boiler rooms. These could be given a reduced height and secured for the engine room about 15 ft. clear height, and for the boilers over 20 ft.; while the headroom of the general cellar is 12 ft. 9 in., insulated, it may be added, by means of a false ceiling consisting of Keasbey & Mattison 85 per cent. carbonate of magnesia blocks, 2 in. thick, placed to leave 3 in. dead air space.

The boiler plant consists of four Babcock & Wilcox boilers of the water-tube type, set in three batteries, as indicated. They have an aggregate of 8,000 sq. ft. of heating surface, with 227.5 sq. ft. of grate surface, or a ratio of heating to grate surface of 35.2 to 1. One boiler has sixteen sections and each of the others 12 sections of tubes, each section of nine tubes 4 in. in diameter and 18 ft. long. The steam and water drums are 36 in. in diameter. The boilers are hand-fired and pea coal is used, brought from the coal store in cars on narrow-gauge tracking furnished by Mr. W. J. Haskins, of New York. The average steam pressure is 125 lb. The smoke flue starts 56x68 in. in size, is changed to an oval cross-section of substantially equivalent area, and is terminated above the roof about 215 or 220 ft. above the cellar level. The boilers have white enameled brick settings.

Steam is taken from the boiler drums at their front ends, owing to the somewhat limited headroom, and is carried horizontally across the firing space to a 12-in. steam header along the boiler-room side partition. The pipes from the boilers are equipped with two valves, one at the header, and the header itself is provided with a valve by which it can be divided into two parts, if, for any reason, it should become desirable to isolate the connections of either pair of boilers from those of the other pair. The controlling valves are thus removed from a place over or near the restricted and hot space over the boilers, and to render them readily accessible a light iron gallery has been suspended underneath the header.

From one section of the header are taken a 10-in. line to the engine room, an 8-in. line to reducing valves for the low-pressure systems for both heating and cooking purposes and a 6-in. pipe to the pump main; while from the other is run another 6-in. pipe also to the pump main, which is thus provided with a double supply. While there is a Potter mesh separator within each steam drum of each boiler, the steam going to the engine room is passed also through a Stratton combination receiver and separator, 36 in. in diameter and 9½ ft. high. From the pump main is supplied the auxiliary generating unit, which can thus be operated in the event of an accident to the engine-room system, because, as stated, the pump main can receive steam from both sections of the main header. The auxiliary set, however, is only large enough to operate the ventilating fan motors and a moderate amount of lighting, chiefly for such service as would be required after regular hours or during holidays and Sundays.

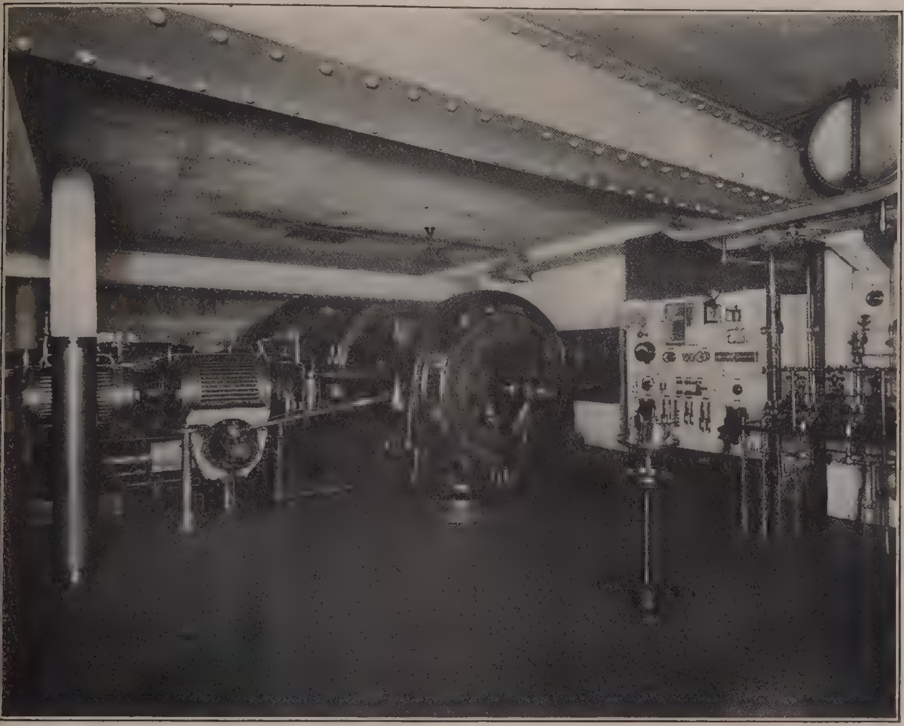
The main generating equipment comprises two 250-kw. and one 150-kw. units, each with a compound engine operated non-condensing, so that its exhaust is available for heating in winter and for the refrigerating plant in summer. The generators, built by the General Electric Co., are of direct current of 242 volts, which is desirable for the considerable number of motors in use throughout the building. The engines are Ball & Wood tandem compounds, 18 and 31x18 in. in



Cellar Plan Showing Machinery Layout and Cellar Ventilating System.

cylinder sizes in the case of the larger engines, and 13 and 23x16 in. in the case of the smaller engine, their normal speeds being 175 and 225 r.p.m., respectively.

The engines are operated 12 hr. a day, from 6 a. m. to 6 p. m., and the average load is 800 amperes, with a maximum of 1,000 amperes, when the ceiling arc lamps in the board room are required. To supply illumination and such other electric energy as may be required during the remainder of each day, a storage battery of 800 ampere-hours capacity, supplied by the Electric Storage Battery Co. is in use. The charging set is a 15-h.p. Western Electric motor-generator or booster outfit. The night load averages 50 amperes. The auxiliary unit is a General Electric marine set, of 50 kw. rating, with an 11x12-in. engine and a 244-volt dynamo, operated at 280 r.p.m. Its steam supply is passed through a Cochrane separator.



Engine Room Showing Steam Supply Pipe at the Left and Lubricating System at the Right.

The engine room is floored with small dark red terra cotta tiles, and the room has a generally good appearance, which is enhanced by the method of enclosing the steam pipes. These are brought upward through the floor from the pipe space underneath and in 180 deg. curves are bent to the engines; their insulation, which consists of Keasbey & Mattison 85 per cent. carbonate of magnesia sectional covering, is wrapped in Russia iron, finished in turn with brass bands. Similar treatment has been accorded the Ward feed-water filter, which is located at the entrance into the engine room, as it is entirely enclosed by a jacket of brass-embellished Russia iron.

Besides the electric switchboards, the equipment of which includes wattmeters for recording the consumption of both the electric power and light installations, there is an extensive gauge board in the room with a gauge for each boiler, and gauges for the pressure on the lines to the humidity regulating coils of the ventilating system, on the lines to the kitchen, on the system for the refrigerating machinery and on the heating system, together with a recording steam gauge and clock.

The pressure system of lubrication of the Siegrist Lubricator Co. is employed, with the pumping equipment at one side of the room. There are four small pumps, being a duplicate set for both the engine and the cylinder oil, with two overhead pressure tanks, one maintained at 160 lb. and containing the cylinder oil, and the other maintained at 100 lb. for the engine oil. In connection with the latter, a White Star oil filter is used.

The elevators are of the Otis hydraulic type and required three compound duplex pumps, of which one is a relay, and a jack pump for heavy duty. The main pumps are 14x20x11x15 in. in size, of the Worthington manufacture. The pressure piping, automatically maintained at 150 lb. pressure, delivers into pressure tanks of which one is placed directly over the water ends of the pumps and the others as near as convenient to the groups of elevators. An installation of six locomotive type Westinghouse air compressors, supported against the cellar wall, serve in part to supply the air in these tanks, but part of them are also used in connection with the sewage ejectors. These are of the Shone type, and were required to lift to the sewers such sanitary drainage as cannot reach the latter by gravity. The remaining important pumps of the plant are the 8x12x17x10-in. compound Blake house pump, and the 12x6x12-in. underwriters' fire pump. Near the latter are two New York filters, through which the city water is passed.

Boiler Room Showing Method of Taking Steam from Front Ends of Steam Drums.

The pneumatic-tube system, which is another of the important adjuncts of the plant, is of particular interest in that the service afforded by the Exchange to the different cable companies must be identical. In other words, messages must carry from the main central tube station to the receiving points in the same duration of time, whether the receiving point is 50 or 250 ft. distant. There are altogether 97 lines of tubes and 4 sec. was the traveling time adopted for all tubes. The system was installed by the Lamson Consolidated Store Service Co., of Boston, and Foster reducing valves were fitted to each end of each tube, set to regulate the time of transit of the carriage. The compressed air is furnished at 30 lb. from an automatically operated duplex Ingersoll-Sergeant steam-actuated flywheel compressor, drawing air from the fresh-air supply intakes. It delivers into a pair of large storage tanks, from which in turn the tubes are supplied.

(To be continued.)

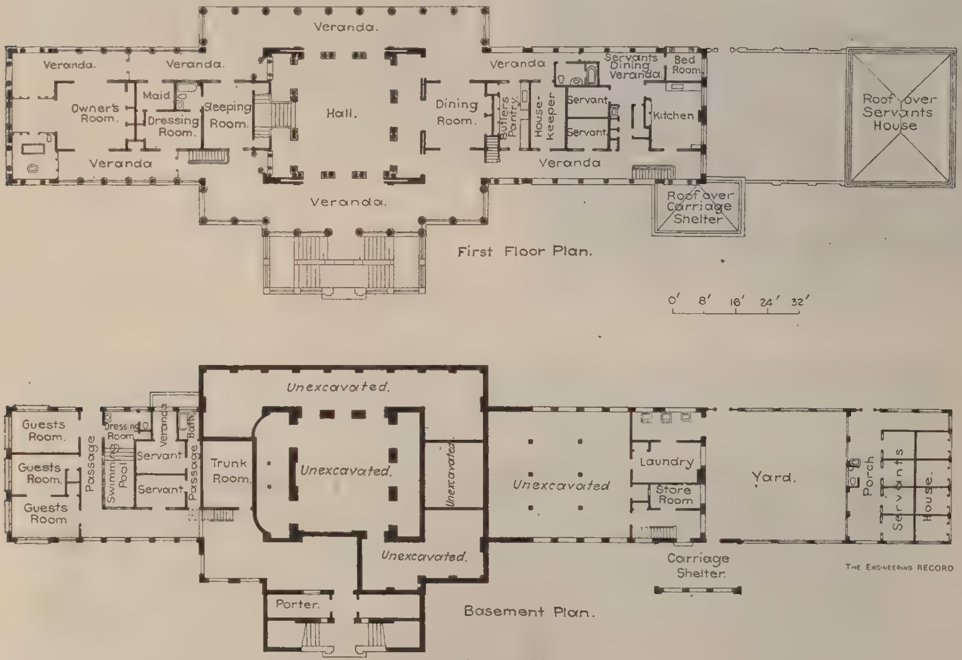
Waterproofing Brickwork.

Waterproofing brickwork has been tested by the Engineering Department of Toledo recently. The experiments were made by immersing soft and sewer brick in various compounds of tar or asphalt for different periods and at different temperatures. After treatment in this way the brick were placed in water for 48 hours. It was found that the treatment had very little effect on the capacity of the brick to absorb moisture. Mr. E. F. Wallbridge, who conducted the tests, states that it has been decided that waterproofing brick by this treatment is not practicable.

Reinforced Concrete Residence at Port Antonio, Jamaica Island.

A somewhat unusual winter home has recently been completed for Mr. Alfred Mitchell, of New London, Conn., on Folly Point opposite Port Antonio, on the island of Jamaica. The establishment comprises two houses, a stable, two pavilions, a power house, a reservoir, a bridge and a gate lodge, constructed wholly of concrete reinforced with twisted steel. Some of the columns and other ornamental members have been turned and polished, much as stone for similar places is worked. The main portion of the house crowns a high knoll overlooking the harbor and the Blue Mountains, commanding the finest views in the whole island; there are wings at either side on the slopes, while beyond one wing and separated from it by the laundry yard is the servants' house, so much lower as to offer practically no obstruction to the view from the main house.

View of Front of Stable Built of Reinforced Concrete.



Floor Plans of a Reinforced Concrete House near Port Antonio, Island of Jamaica.

Good lumber is costly at Port Antonio, and a frame building would not be very durable in that climate. But the island is of coral formation, and so coral rock was available which, although it could not be cut as a building stone, was suitable for concrete. Concrete buildings required a smaller number of skilled mechanics than any other type, and as all such men had to be brought from the United States, and maintained on the work, this was a great advantage. Furthermore, the concrete house would be far more proof against vermin, moisture and other annoyances common in warm climates. Walls, floors, roofs, stairs and columns are all of concrete, reinforced wherever necessary with twisted square steel rods of various sizes, and only the doors and frames, the window frames and sashes, and the shutters or "jalouses," as they are locally known, are of wood. Practically all the supplies and machinery, including the 2,500 barrels of Giant Portland cement used for concrete and plastering, were imported from the United States.

Clean and coarse, but not very sharp, coral sand was obtained from the beach. Native coral rock from a quarry opened on the estate, near the site of the house, is of a light yellow color. This is overlaid with clayey earth of a very brilliant crimson color. The stone was thrown upon the bank to weather in the daily rains, but still part of this red clay clung to it and went through the rock crusher. A little lime was used in the concrete in order to make it whiter. The earth and lime act to give the concrete a warm flesh tint, very different from the usual slate blue or clear gray of cement. The effect is said to be the most pleasing tone in concrete which has yet been produced in wall construction, and after the surface of the concrete has been removed by chipping with pneumatic tools or by washing with dilute acid, thus obliterating all board marks made by the forms, the resulting color is as handsome as that of almost any natural building stone.

The walls, bases and columns of the main entrance hall were finished with a polished terrazzo surface of the concrete just described, and in appearance are somewhat like Sienna marble. The columns were cast in sand molds, turned and polished in the contractor's works in Boston, and shipped in crates, some of the coral rock having been sent to Boston for that purpose. Some of the concrete surfaces finished by washing with acid soon after the removal of the forms show the coral rock and sand and look like fine-pointed or hammer-finished natural stone. All floors in the basement of the wings and the kitchen have granolithic finish. The floors of the central portion and the chamber wing are finished throughout with English red quarry tiles, 9 inches square. All floors on the second story are finished with glazed Italian tiles of a large variety of designs. All walls are plastered with Portland cement mortar, just enough lime being added to make the cement spread easily under the trowels.

The coral was broken in a Gates rock crusher, the-run-of-the-crusher being used in the concrete, which was mixed in a Smith concrete mixer with salt water pumped from the shore into an elevated tank so as to flow by gravity to the mixer and other parts of the work. An Erie engine was belted directly to the crusher and also turned a

General View of a Reinforced Concrete House at Port Antonio.

jack shaft, which drove two Lidgerwood hoisting drums, the concrete mixer, a circular saw and an air compressor. Before the contractor's plant was installed, some stone was broken by hand and a little concrete was mixed by hand. On this hand work native women laborers were employed to some extent at eighteen cents a day. The price paid for crushing rock by hand was six cents per barrel. Fresh water was very scarce, and could be afforded only for domestic uses and steam making; the supply was pumped from a well to a cask on a wooden tower, high enough to feed the boiler inspirator by gravity. In the future the clean rain water from the concrete roofs will be saved in a cistern beneath the kitchen wing in order to supplement the supply from the well. From this cistern the water will be forced by an automatic electrically driven pump into a storage reservoir on the hill, high enough to give 18 ft. head on the highest fixtures in the house.

Trenches were dug for wall footings of sufficient depth to get good foundations. No other excavations were made beneath the main house except for a trunk room, but basements were made beneath the wings, since, owing to the slopes of the hill, but little excavation was needed at these places. Under all other parts of the first or ground floor the earth was trimmed or filled to subgrade and compacted to receive the concrete. After the wall footings had been put in, a 3-ft. gauge track was laid from the quarry and the beach to the concrete plant. The concrete in wheelbarrows was raised by an elevator from the mixer and distributed over the building by means of runways.

The coral in the quarry is very much honeycombed. High, medium and low-grade dynamites were used for blasting, with poor results. A slow-burning black powder proved to be most satisfactory for loosening the stone. On account of the run-of-the-crusher being used for concrete the latter was very dense and although no provision was made for making the concrete of the floors and roofs watertight, they proved to be so. Before the tar and gravel were placed upon the roofs, the conductor outlets became stopped and the parapets held in some cases 5 inches of water without any leakage through the roof. Owing to the uniformity of the temperature, there have been no contraction cracks due to shrinkage. Wall surfaces 73 ft. and 90 ft. long have been built without cracks, and with but a limited amount of reinforcing steel. On Jan. 26 there was a very perceptible earthquake shock, but no damage whatever was detected in the house subsequently.

The house is lighted by electricity from a power house on the estate, which is equipped with a 25-h.-p. Otto gasolene engine belted to a General Electric Co.'s direct-current dynamo. There are eight bath-rooms with up-to-date open plumbing. The stable is built around a courtyard, there being box stalls on one side for six horses. On the opposite side there are a carriage room, storerooms and several chambers for the coachmen. The gate lodge stands on filled land close to the sea, at the entrance to the estate. An old swamp full of brush, just at sea level, was filled in with about 2 ft. of clayey soil. A test load of about 1,200 lb. per square foot was placed upon this and a number of observations taken at low tide, which showed a settlement of ½ in. A later reading chanced to be taken at flood tide and showed that the test load was raised ⅛ in. above its original position. As the gate lodge is a light structure, it is rigidly tied together by the reinforcing steel, and will probably rise and fall with every tide.

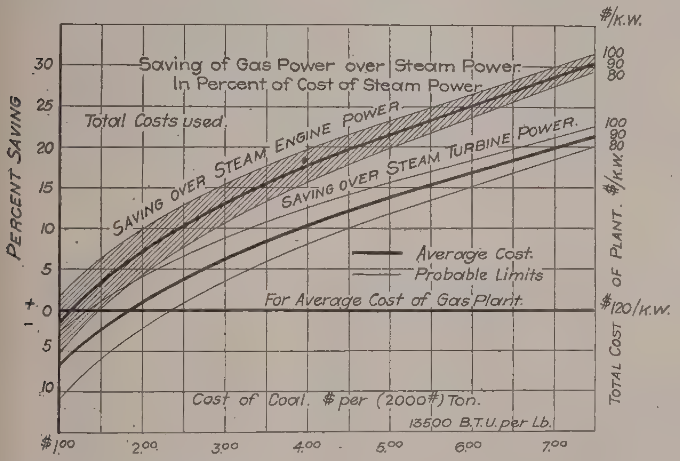
This house and its appurtenant buildings were designed by Mr. Horace S. Frazer, of Chapman & Frazer, architects, Boston, and the general contract was awarded to the Aberthaw Construction Co., Mr. Leonard C. Wason, president, also of Boston. Prof. Arthur W. French, of the Worcester Polytechnic Institute, was the resident superintendent for the contractor during the past summer. As an aid to the superintendent in making weekly progress reports to the home office, the architect's principal drawings were lithographed at a much reduced scale and printed on 24x36-in. sheets of bond paper in such a way as to leave plenty of room for notes about each plan or elevation or detail. Colored pencils were used to indicate progress of various divisions of the work, thus showing at a glance the state of the buildings at the date of any report.

LACK OF WATER for fire service at Mayfield, Ky., was claimed to have caused very heavy losses during a fire in June, 1901. An insurance company sued the local water company for its losses on this account. The contract between the city and company required the latter to keep all fire hydrants supplied with water and maintain them in effective working order except while repairing a hydrant rendered unserviceable for any other cause than willful negligence, and specified the character and dimensions of the standpipe, the size and depth of the water mains, the character and number of the pumps and the requirements of the public test. Just before the fire the plunger in one of the three wells furnishing the supply stuck and could not be moved. The company was working day and night to repair this trouble when the fire occurred. Ordinarily the two remaining wells would furnish enough water for all purposes, but the weather was very warm and there was an unusual demand for water in consequence. The Kentucky Court of Appeals has just decided, 85 S. E. Rep. 205, that the company was not liable for a deficiency of water under these conditions, which were not due to negligence of any character on its part.

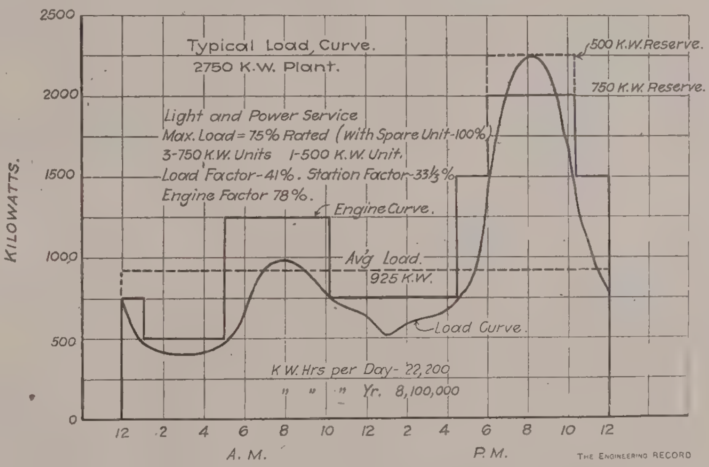
Power Production from Gaseous Fuel.

An interesting discussion of the present opportunities and future possibilities of power production from gaseous fuel was read last month before the Ohio Gas Light Association by Mr. J. R. Bibbins. In a general way he believed that producer gas would become the fuel of the future for power plants. With 85 per cent. useful efficiency in the producer and 27½ per cent. in the engine, the plant would have a combined efficiency of 23.2 per cent. With a steam plant there is 70 per cent. efficiency in the furnace and boiler and 15 per cent. in the engines, or a combined efficiency of 10½ per cent. for the plant. The important improvement necessary to reach this gas-plant efficiency is the attainment of some method of complete gasification of bituminous fuel, including the tar and other compounds. Only in this way will cumbersome cleaning apparatus be avoided and bituminous coals become generally available for producer gas plants.

Many industries produce large quantities of organic wastes in some form of gaseous, liquid or solid combustible. Some of these gases can be used in gas engines, after cleaning, such as blast-furnace and coke-oven gas. Other wastes may prove available for use in a producer, such as sawdust, spent tan bark, and the refuse from wood-working factories.



Saving of Gas over Steam in Typical Case.



Typical Load Curve for Comparative Estimates.

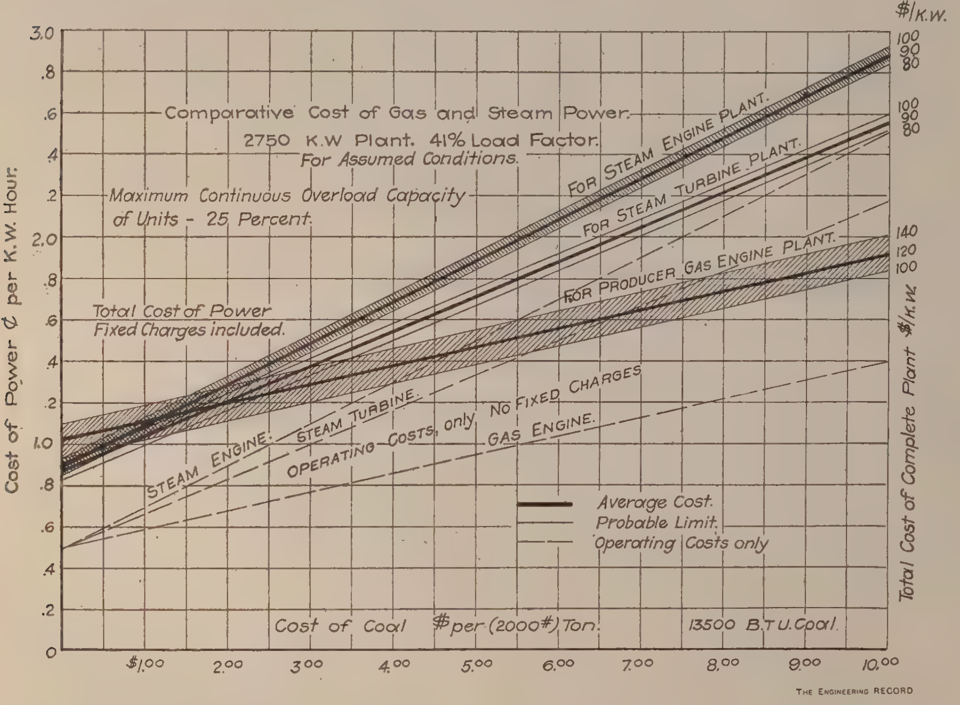
In 1902 there were 3,620 central lighting and power stations in this country employing 1,800,000-h.p. in prime movers, approximately three-fourths of which was steam power, the remainder hydraulic. No representation was given to the gas engine, although it is certain that a number of American central stations are operating exclusively upon gas power to the extent of several thousand horse-power.

In 1902 there were 1,400,000 h.p. of prime movers in electric railway service, 96 per cent. of which was steam power, 3.8 per cent. hydraulic, and under 1 per cent. gas power. Of the total steam power, 67 per cent. was represented by engines above 500 h.p. and 44.3 per cent. by engines above 1,000 h.p. capacity. But five companies reported the use of gas engines, these ranging from 75 to 600 h.p. As a number of companies rent power, the gas power representation is less than it should be by at least three or four companies to the author's own knowledge. Here is a wide field for the high-power gas engine, and the example set by the Warren & Jamestown Ry., which is building a single-phase gas power interurban road, will, Mr. Bibbins hoped, be emulated by American railway systems.

Coming finally to the broad subject of power equipment for central stations of large powers, it is instructive to study a typical case in all its phases, particularly from the commercial standpoint. Can gas power compete with steam power, at present cost of fuel and equipment? Mr. Bibbins' answer is decidedly in the affirmative, within certain ranges of fuel cost. The following estimates, based upon a typical load curve, may throw light on this question. In order that they may not be misconstrued, the principal assumptions are given below:

The plant is assumed to be a high-grade, carefully-operated station of 4,000 h.p. capacity, running 24 hr. daily, and having the load curve shown. The continuous overload capacity of the units is 25 per cent. The load factor is 41 per cent., the station factor 31⅓, and the engine factor 78. The efficiency of the gas engine at 0.8 load is taken at 18,220 B.t.u. per kilowatt-hour, of the steam turbine at 22 lb. of steam, and of the engine at 26.2 lb. The actual average evaporation, including stand-by losses, is 6 lb., with 12,000 B.t.u. coal, 7½ lb. with 13,500 B.t.u. coal and 8 lb. with 14,500 B.t.u. coal. The steam for auxiliaries is assumed to be 10 per cent. The average producer efficiency is taken at 75 per cent.

The estimates are based on a brick and steel building with foundations, coal handling and storage plant, horizontal double-acting direct-connected gas engines condensing turbo-generator units, water-tube boilers, with stokers and economizers, complete piping, an air compressor starting equipment for the gas engine and a complete producer plant.



Comparative Cost of Gas and Steam Power for Conditions Shown by Load Curve.

The depreciation on the buildings is taken at 3 per cent., boiler plant 6⅔ per cent., engines 6⅔ per cent., turbines 5 per cent., producer plant 5 per cent., and switchboard 3 per cent. The interest on the investment is taken at 5 per cent., and taxes and insurance at 2 per cent. The cost of labor, supplies and repairs is taken at 50 cents per kilowatt-hour.

The results of the above assumptions are embodied in the second diagram. As the cost of equipment is subject to some variation, three cases are given covering a reasonable range of cost, also the cost of power with and without fixed charges included. Operating costs alone are, of course, greatly in favor of gas power. Thus, at $4.50 coal the saving is nearly one-third.

At points of intersection of the diagonals representing total costs, the cost of power is the same. At such points the steam plant can deliver power as cheaply as the gas plant. This is reasonable because of the higher fixed charges on the gas power equipment. If the first cost of both plants were the same, the cost of power with free fuel would be the same. The average lines approximate very closely (within $2 per kw.) the estimated cost under the assumptions.

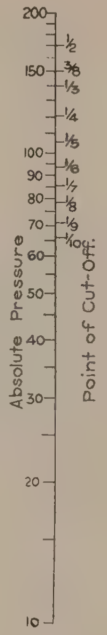
In the third diagram a typical case is worked out, showing the saving of gas over steam power expressed in percentage of cost of steam power. This shows that with coal costing $4.50 per short ton the total cost of steam-engine power may be reduced 20 per cent. by the use of gas power. It also shows the limiting costs of coal—$1.15 for a steam-engine plant and $1.85 for a steam-turbine plant. Under the previous assumptions these limits were $1.20 and $2, respectively.

From the above it is reasonably apparent that at present a producer gas plant finds its best field of operation in regions where fuel is not dirt cheap. Few plants, however, obtain their coal at less than $1 or $1.25 per ton, so that in reality gas power is in entirely open competition with steam power, although to a somewhat less extent with steam turbines than with steam engines. Since 1900, British coal has averaged $2.50 per ton at the pit mouth. American coal averaged $1.38 during 1902. It is certain that in the Western States and Mexico fuel is abnormally dear, reaching $10 per ton in those sections where hydraulic development has been largely resorted to.

In conclusion, it is scarcely necessary to emphasize that no fixed set of conditions such as the above can be broadly applied. Owing to the large number of variables entering into the cost of power, conclusions are necessarily modified somewhat by local conditions. The above estimate has been worked out without unduly favoring either gas or steam, and should be considered conservative, rather than the opposite. The costs and efficiencies chosen represent so-called "good practice," not the lowest possible. The method followed is believed to be logical, and the results certainly presage a future for gas power of which the present is but a glimpse. With constantly improving methods and materials of manufacture, the present handicap of cost will tend to disappear, and the higher efficiency of the gas power cycle will become appreciated at its true value.

A Mean Effective Pressure Diagram.

The engineers of the Deane Steam Pump Company have been using for some time with satisfactory results the accompanying little diagram for determining the mean effective pressure of the steam in an engine cylinder. The rules for its use are simple:



First, take the distance from the top of the scale to the point indicating the cut-off. This can be done with the dividers or by a couple of marks on the edge of a piece of paper.

Then place the upper point or mark on the given initial pressure, and the lower point or mark will stand at the required mean effective pressure. The pressures are absolute, 14.7 lb. more than gauge pressure.

This scale is considered by those employing it to be as accurate and much less confusing than the radial line charts sometimes employed for the purpose. It is also much less cumbersome than some of the tables which have been prepared for the same purpose.

In this connection it may be pointed out that this diagram is merely a single example of a great number of such things which have been found useful by engineers in their own work and ought to be made public. There is no business advantage of any sort in keeping such time-saving devices hidden away, while the publication of descriptions of them is of service to many engineers. This applies not only to steam engineering, but also to other branches. Things of this sort are to be found in most large designing offices, and engineering journals are always glad to receive them for publication. It is sometimes said that they are so simple as to merit no room in such a journal, but an explanation of any such diagram as this, which is novel and useful, will always find a place in technical papers.

Letters to the Editor.

Durability of Steam Turbine Vanes.

Sir:—There has recently been brought to our attention from numerous sources a report on the alleged short life of the vanes in steam turbines, stated to have been inspired by an European engine builder. The sole evidence rests upon photographs of turbine vanes purported to have worn out with less than one year's service. This report bears all the earmarks of misinformation, if not of malicious falsehood, especially as similar photographs have been covertly circulated in this country as representing the experience in various American turbine plants. We therefore ask the courtesy of your columns for a brief statement of facts, and are content to leave to the good judgment of your readers the conclusions to be drawn therefrom.

The text of our argument we find in the following passage: "As to the cost of maintenance and repairs, it is claimed that there is an enormous wear (meaning erosion) in the back of the turbine blades. . . ." Photographs of both convex and concave sides of a new and a damaged vane are shown. From a careful examination of these photographs we conclude, first, that the supposed erosion is probably due entirely to an accident in which the blade in question had been badly damaged by the flying particles, but not entirely broken off; or, second, that a new blade has been deliberately injured for illustrative purposes; or, third, that it has been in a class of service the severity of which we have no conception.

The photographs in question show that both edges of the blade have been curled over, so that in the position in which the photograph is taken, a considerable portion of metal appears to have been eaten away. There is also conspicuous evidence of the indentations of a round-nosed instrument on one of the damaged edges and of a chisel upon the other. Such injury is manifestly not due to normal wear, as the innocent-looking title would lead one to believe: "Same bucket after having been in use less than one year."

A skillful photographer can, by adjusting lights, shades, and focus, create most convincing effects. To illustrate, we have photographed a turbine blade, Exhibit 1, which was taken out of an experimental machine in which several rows of vanes had been damaged, due to accidental distortion of the casing. This photograph bears a striking resemblance to those referred to above, and shows how easily a false impression may be created. You will observe that this blade bears strong evidence of erosion upon the back, whereas it was in fact a new vane damaged in the manner shown simply by bombardment of small broken particles of other vanes. If the photograph had been taken slightly out of focus, the edge shown curled over in the view of the concave side would have appeared to be badly eaten away. The concave surface is of course intact.

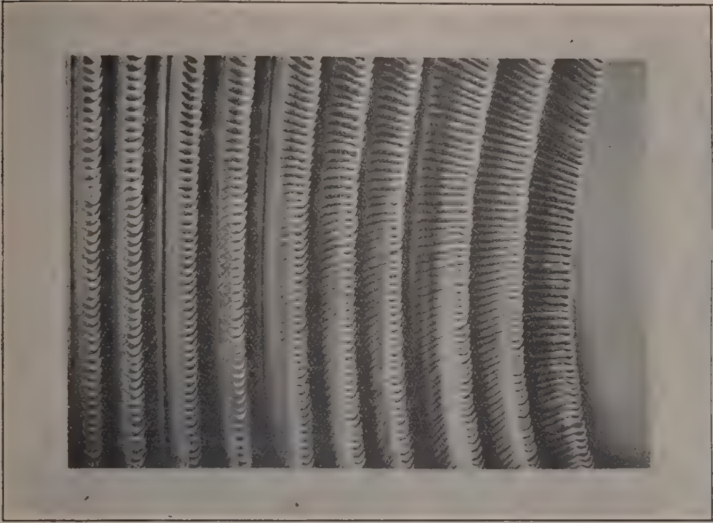


Exhibit 2 B.—Detail View of Upper Half of Stator.

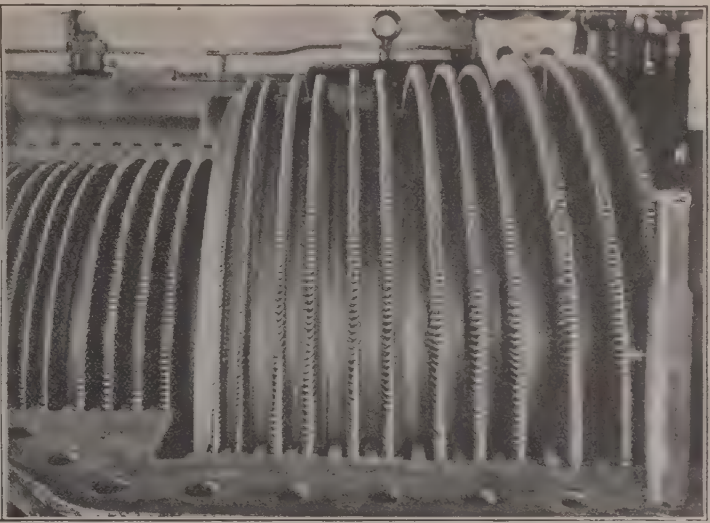


Exhibit 3 B.—Detail View of Rotor.

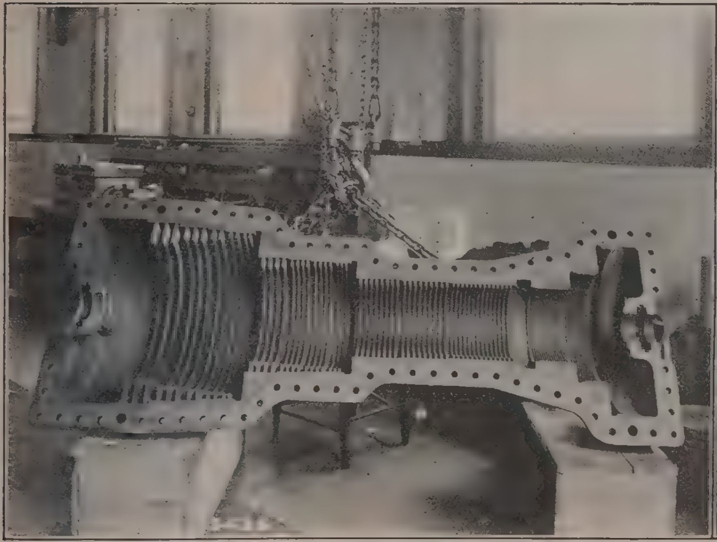


Exhibit 2 A. —Interior of Upper Half of Stator.

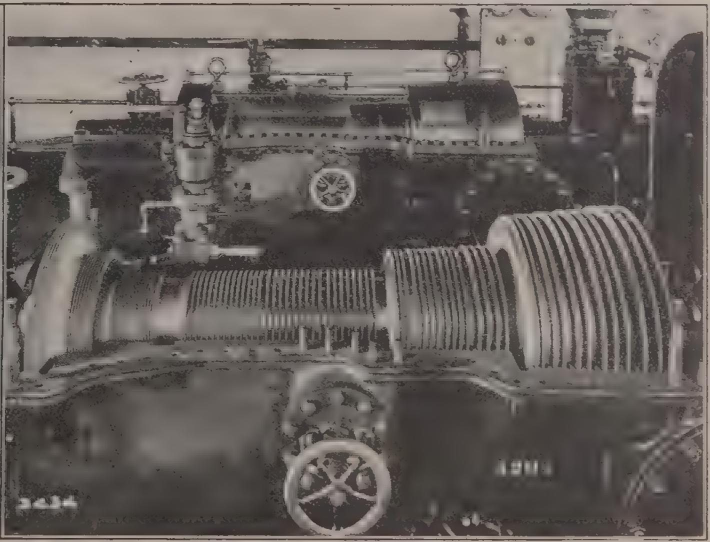


Exhibit 3 A.- Rotor of 400-Kw. Turbine.

In support of our contention that steam erosion in the Parsons type of turbines is quite negligible owing to the low steam velocities employed, we have recently photographed the interior of the first steam turbine put into practical use in America and the first turbine built by us for commercial service. This machine was installed in 1899, and, together with the three units installed soon after, has since been in continuous service upon a 24-hour factory load. Exhibit 2A shows the upper half of the stator; Exhibit 3A the upper half of the rotor; Exhibits 2B and 3B closer views of stator and rotor respectively. In the last two views a position was chosen looking directly along the cutting edges of the vanes to show their condition after over five years' continuous service.

In order to exhibit this still more clearly in detail, two vanes were deliberately broken out of the eighth and twelfth rows respectively of the low-pressure barrel where the greatest quantity of moisture occurs and where erosion would, if at all, be expected. These are shown in Exhibits 4 and 5. Although reproduced as sharply as possible, the old vanes are even in better condition than they appear, and their metallic surfaces have retained the original polish of new vanes as they come from the drawing machine. Exhibit 6 shows one of these specimens set on edge alongside of a new vane of similar size. The end of the new vane appears rough, as it has been sheared off and not ground true, as would be the case when finally inserted in a finished machine.

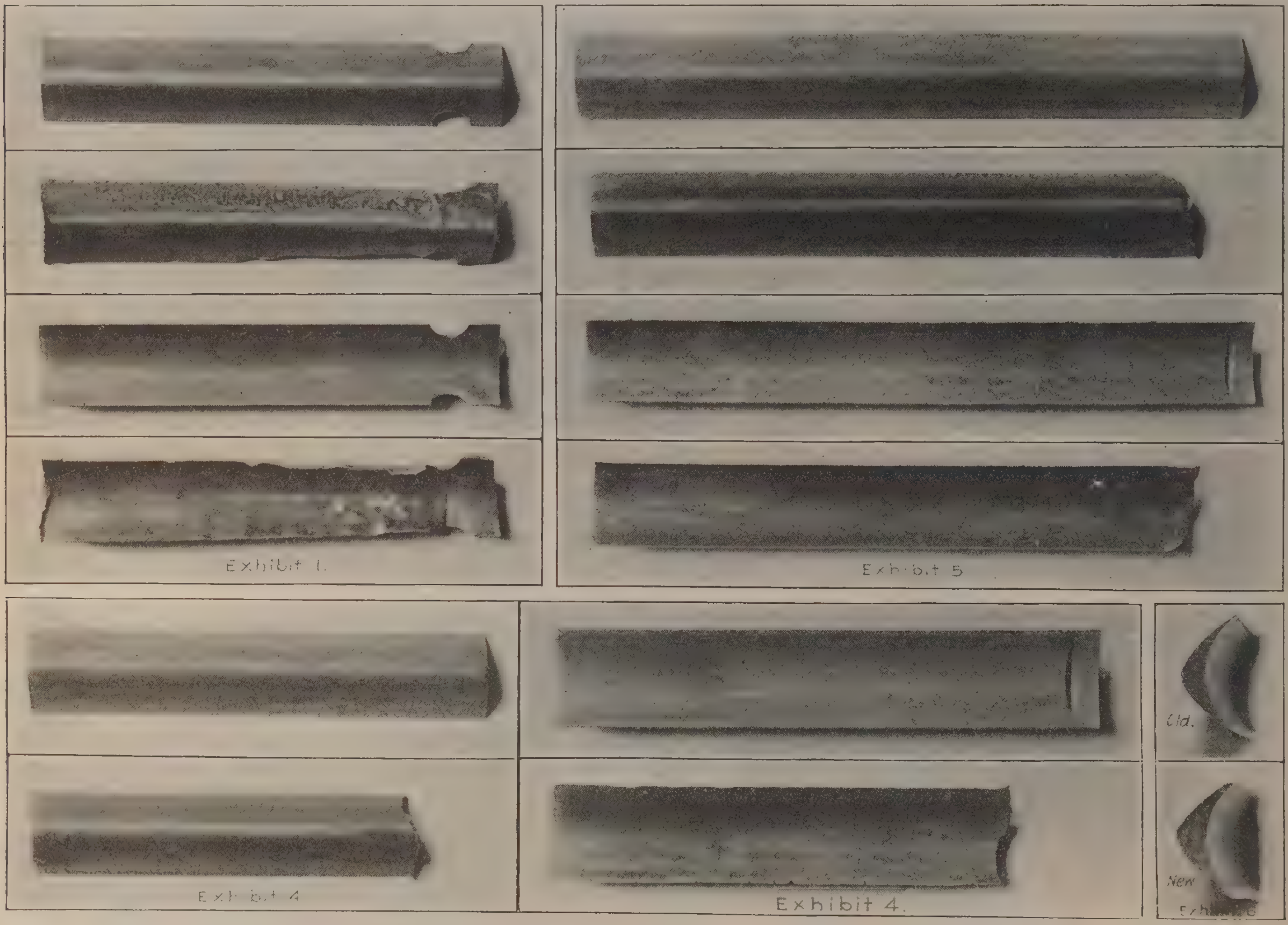
Three facts must be apparent from these photographs: First, that the old vane has retained its full cross section and hence its full mechanical strength; second, that the vane angles, and hence the efficiency are unimpaired in service; third, that the surfaces along which the working steam passes have not lost their original smoothness.

The only effect traceable to steam wear on the vanes of this turbine is to be found in the case of vanes which have been set slightly out of line with the remaining ones of their particular ring. In such cases, the area projecting into the steam space becomes slightly scored on the advancing side, presumably due to their contact with particles of moisture coursing through the lower stages of the turbine during light loads when their velocity in this region is probably somewhat less than normal. This effect, however, but occasionally develops and simply results in the sharpening of the cutting edges of the vane to such fineness that a piece of heavy cord may readily be severed. In no case has the section of metal been worn away to any appreciable extent. The vane reproduced in Exhibit 4 was slightly out of line, and shows this effect as much as any other in the turbine.

In judging the results obtained from this turbine, it should be borne in mind that the steam supply has always been excessively wet, owing partly to a long run of steam piping. No superheaters are used. On several occasions the turbines have been checked considerably below their normal speed from the effects of slugs of water passing through them. It also frequently occurs that creek water has to be put into the boilers owing to the failure of city water supply. This water is at all times extremely acid and very impure. In fact, it has been necessary to coat the outer surface of the dummy pistons with white lead to prevent their corrosion from this acid water. Owing to the accumulation of sediment, the turbines have to be frequently cleaned by air blast, as the steam velocities are not sufficient to keep the passages clear.

In conclusion it should be recalled that the turbine on exhibit represents the beginning of the present turbine industry in America. Its failure would have been even more conspicuous than has been its success. It is therefore reasonable to suppose that improved methods of manufacture and increased understanding of the turbine art should have resulted in an improved machine rather than the reverse, as our detractors would have you believe.

Respectfully,
The Westinghouse Machine Co.
East Pittsburg, March 31.



Exhibits of Blades of Westinghouse-Parsons Steam Turbines Showing Effect of Different Kinds of Treatment.

INFORMATION DESIRED CONCERNING EXPLOSIONS IN SEWERS.

Sir: There is a subject on which I should like to have the opinion of sanitary engineers, and that is so-called sewer-gas explosions in sewers. We often see it stated that an explosion has occurred in a sewer from sewage gas, yet so far as I can learn there has been no proof that these explosions were caused by any gas formed from the decomposition of organic matter in the sewers. We know of explosions in septic tanks from sewage gas, but as regards explosions in sewers, I believe they are caused by illuminating gas leaking into such conduits from defective gas mains and not by sewage gas. Any definite instance of an explosion due to other cause than illuminating gas will be much appreciated.

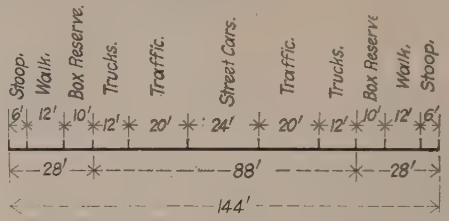
Your truly,
P. K. Leonard.
Chicago, March 24.

A TENTATIVE STREET PLAN.

Sir: Conversing some time since with a merchant, who has had large experience in the jobbing and wholesale trades of this and other cities, on the requirements of a street for large and heavy business, on which both foot and wheeled traffic should be conducted without costly delays from traffic obstructions, the following widths between house fronts were thought desirable, if not necessary.

Six feet, it was thought, is narrow enough for a stoop, and 12 ft. will allow two men side by side when walking 3½ miles per hour to meet and pass another walking at the same rate without breaking speed. The box reserve was thought to be sufficient if there was competent supervision of the thoroughfare. This gives a sidewalk width of 28 ft.

The space assigned for trucks seems requisite by the common use in the dry goods district, although longer trucks are used. The width of the traffic way and the space assigned to street cars seem more open to debate than the other items. It was thought desirable to provide space not only for heavy loads at, say, 2½ miles per hour and for express wagons, etc., going at the rate of 6 to 7 miles, but also for what are getting to be nearly, if not quite, common speeds of 12 to 15 miles per hour. This traffic, which for some time will not be considered a business traffic, though much business may be dependent on its speed, should take its chances on the trolley tracks when two teams happen to be abreast, as the heavily loaded teams cannot be expected to swerve in towards the curb.



Street Section in Warehouse District.

This is not contributed to your valuable pages as conveying *ex cathedra* information, but merely as a suggestion covering most of the elements to be considered in planning a business street.

Edward P. North.

Blast-Furnace Gas Engines direct-connected to electric generators are employed in a foundry at Esch, Luxemburg, the pair of horizontal single-acting 35.4x41.3-in. cylinders on opposite sides of a 19.7-ft. flywheel. Their speed is 120 r.p.m., and they are guaranteed each to develop a continuous output of 660 h.p. with blast-furnace gas of 96 B.t.u. calorific value per cubic foot, and a dust content of 0.001 oz. per cubic foot.

CURRENT NEWS SUPPLEMENT

APRIL 8, 1905.

TORY OF NATIONAL TECHNICAL SOCIETIES.

ican Society of Civil Engineers. Sec-
Chas. Warren Hunt, 220 West 57th St.,
rk. Annual convention, Cleveland, June
Next meeting, April 19.

ican Society of Mechanical Engineers.
y, F. R. Hutton, 12 West 31st St., New
Next meeting, New York, April 25,
m.; last reunion of the season, to which
are invited; paper by Mr. G. C. Hen-
diamond tools,

ican Institute of Electrical Engi-
Secretary, Ralph W. Pope, 95 Liberty
w York. Annual convention, Asheville,
June 19-23. Next meeting, at Carnegie
pril 28; four papers on meter subjects.

ican Institute of Mining Engineers.
y, R. W. Raymond, 99 John St., New

ican Institute of Architects. Secre-
lenn Brown, Washington, D. C.

iation of Engineering Societies. Sec-
John C. Trautwine, Jr., 257 South
St., Philadelphia, Pa.

ican Society of Heating and Venti-
Engineers. Secretary, W. M. Mackay,
ter St., New York.

dian Society of Civil Engineers. Sec-
Clement H. McLeod, 877 Dorchester St.,
l.

ty for the Promotion of Engineering
on. Secretary, Prof. M. S. Ketchum,
ity of Colorado, Boulder, Colo.

ican Society for Testing Materials.
y, Prof. Edgar Marburg, University
sylvania, Philadelphia, Pa.

ican Society of Municipal Improve-
Secretary, George W. Tillson, Room 12,
al Building, Brooklyn, N. Y.

iation of Railway Superintendents of
and Buildings. Secretary, S. F. Pat-
Concord, N. H.

ican Railway Engineering and Main-
of Way Association. Secretary, L. C.
1562 Monadnock Block, Chicago.

ican Water-Works Association. Sec-
J. M. Diven, Charleston, S. C. Annual
ion at West Baden, Ind., May 8 to 12.

ican Foundrymen's Association. Sec-
Richard Moldenke, P. O. Box 432, New

e Builders' Association of the
States. Secretary, J. L. Lyle, 39 Cort-
t., New York.

ican Foundrymen's Association, Sec-
Richard Moldenke, Watchung, N. J.

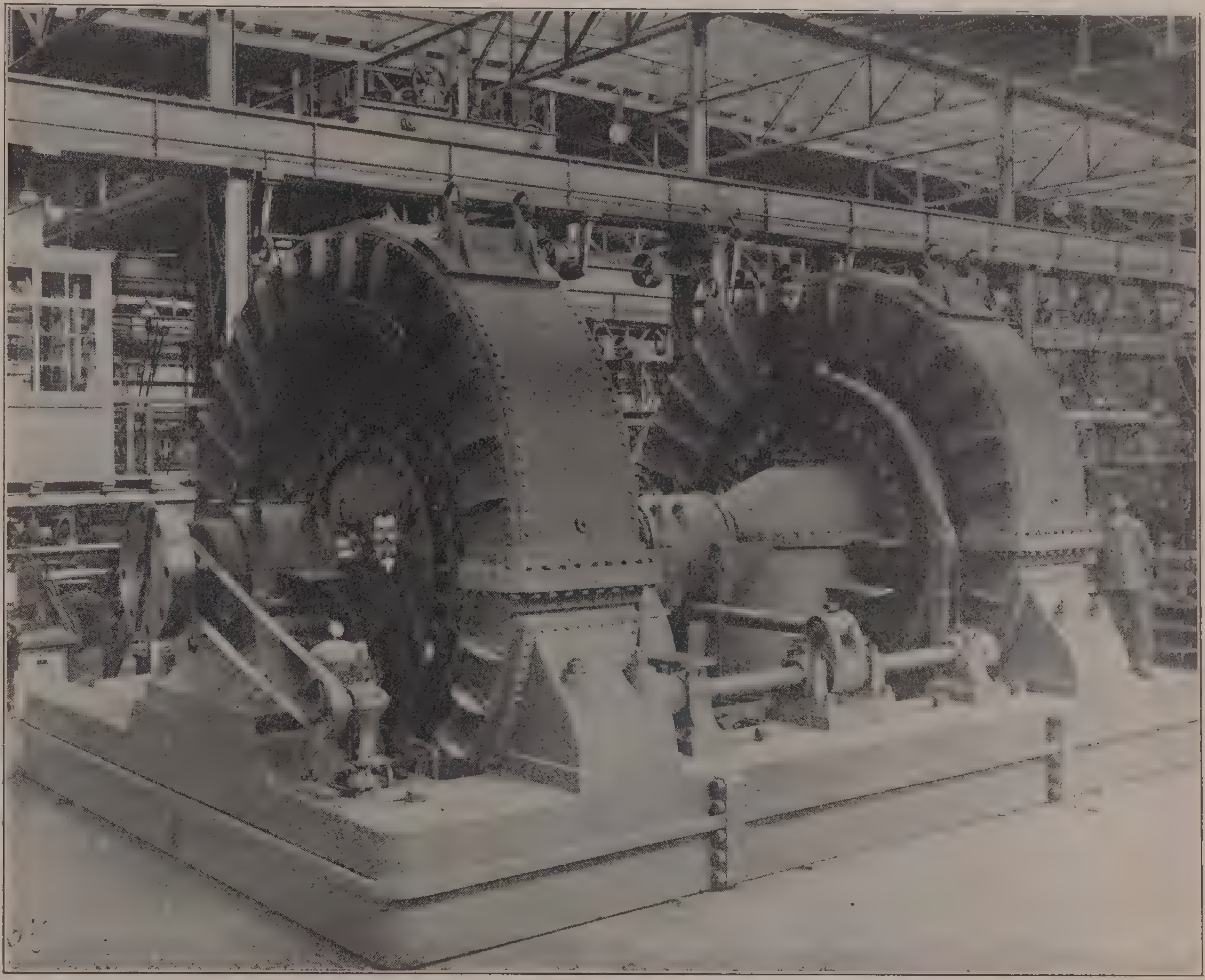
NES OF THE ONTARIO POWER CO NIAGARA FALLS.

is probably the largest capacity hori-
pe turbine ever built has been assembled
ower house of the Ontario Power Co. of
Falls. A photograph of the turbine,
bled in the shops of the manufacturer,
duced herewith. The turbine stands 13
ight above the floor, and the bed plates
21x29 ft. It was designed and built
. Voith, Heidenheim a. d. Brenz, Wurt-
Germany, and is the first of twenty
re comprised in the ultimate develop-
200,000 e.h.p., now the figure given out
apacity of the hydraulic works. Each
is to drive a 10,000-h.p. generator and is
11,390-h.p., with 700 cu. ft. of water
nd, a speed of 187½ r.p.m., and an
head of 175 ft.

urbines are of the inward flow, double
type, having two runners 78 in. diam-
h capable of developing 5,700 h.p. The
controlled at the turbine by swivel
hich also act as guides. Lombard gov-
ill be used. Relief valves are provided
d of each penstock, discharging directly
tail race.

enormous turbines are supplied by pen-
ft. in diameter, which enter the power-
low the floor level. Where each pen-
ters the building, a heavy thrust flange
ded in the enormous mass of concrete
which forms the foundation of the entire plant. The thrust of the water column equals 650,000 lb. for each turbine. The turbines are set above, to one side of, and with shafts parallel to the penstocks, so that the supply pipes turn an angle of 90 deg. on the horizontal, and 45 deg. upward. The supply pipe ends in a spiral housing of heavily reinforced plates. The arrangement of the machinery was described at length in The Engineering Record of Oct. 22 of last year with plan and cross-sections of the power house.

The 175 ft. of head is made up of 155 ft. above the center of the shaft, and 20 ft. below. As the water level of the river varies greatly on account of the narrowness of the gorge, the tail race is separated from the river by a weir, with a crest 7 ft. above normal river level.



ONE OF THE 11,390-H.P. DOUBLE HORIZONTAL TURBINES FOR THE ONTARIO POWER CO. OF NIAGARA FALLS.

Both draft tube and tail race below the floor level are entirely of concrete.

On account of the large and heavy pieces which go to make up the turbine, special cars were necessary for transportation. The second turbine has also been received, while the third has been shipped, and the fourth is under construction.

TESTS OF CAREY ROOFING.

The Factory Mutual Underwriters have held the position for many years that the points to be considered in selecting a factory roofing material were the relative costs of the different types, their relative weight and their relative durability, the last being the most important. They have accepted either tar or gravel roofing put on by reputable parties, warning being given that the tar must be of suitable quality and not volatile. Recently one of the members of the Factory Mutual System, having charge of works of many acres extent on which Carey's magnesia flexible cement roofing was in use, requested an exhaustive test of that material, which has been made by Prof. Charles L. Norton at the Insurance Engineering Experiment Station in Boston, under the general direction of Mr. Edward Atkinson. From the official report of this test the following notes have been abridged.

Specimens of Carey roofing and of tar-and-gravel roofing of ages ranging from ten days to twelve years, were submitted to identical tests. All of the specimens were approximately 24 in. square and were mounted on a backing of ⅞-in. sheathing plank about 4 in. wide, cleated together.

The first tests were made by submitting specimens of both types of roofing to the action of a powerful Bunsen burner for 15 minutes. The specimens were inclined at an angle of 45° with the horizontal and the burner was held 3 in. from the roof. This test showed that the tar-and-gravel roofing burns more vigorously when once ignited, giving more flame and smoke, but the tests did not cover a large enough area and were not severe enough to demonstrate any other difference between the two types of roofing.

A test with three Bunsen burners instead of one was next made in the same manner. It showed that the tar-and-gravel samples burned with more vigor than the Carey specimens and that there was a greater tendency of the fire to spread. There was no great difference in the amount of charring of the wooden backing, or in the tendency to continue to burn unless stirred, when the tar was much more persistent.

The third test was made by exposing the roofing specimens for ten minutes to the flame of a powerful compound blast lamp. Tests were made with the specimens at 45° and repeated with them in a horizontal position. On examination after the tests the area of roofing destroyed and the extent and depth of charring of the sheathing were practically the same with some of the older Carey and tar-and-gravel roofs. In no case did the latter make a better showing and in general they made a much poorer showing.

The next tests were for the purpose of determining the relative resistance of the two types to the action of burning embers. Three pieces of 7x1½x½-in. pine were set on fire and then placed on the roofing side by side about ½ in. distant from each other. This test showed no material difference in the degree of protection afforded by the two roofs. A more severe test was made by spreading ¼ in. of sawdust saturated with kerosene on each specimen and setting it on fire. The results were practically the same with both types of roofing.

To test the relative resistance of the roofing to the sparks from a locomotive and bits of iron and coke that fall on a foundry roof during a blast, the following test was made: First, a crucible full of pieces of iron weighing about 0.1 to 0.3 oz. was poured when heated to a bright red heat on the specimens under test. This was repeated at higher temperatures up to 2,250° Fahr. Then a larger mass weighing 4 oz. was similarly heated and placed on the roofing. Both types of roofing were ignited and burned from 3 to 5 min., there being no noticeable difference in this respect.

The conclusion drawn by Professor Norton from these tests is stated by him as follows: "As a result of these tests and of the examination of a great number of Carey roofs and gravel roofs in New England, New York, New Jersey and Pennsylvania, I am convinced that the Carey roof is, under any conditions, as safe as the tar-and-gravel roof, and in the majority of cases is distinctly safer. Its chances of ignition are less and its liability to continue to burn and cause spread of fire is less."

THE EXTENSION OF THE NEW YORK RAPID TRANSIT RAILROAD SYSTEM.

The New York Rapid Transit Railroad Commission received last week from its committee on plans and contracts its long-expected report on routes for future subways. The most interesting portions of the report are the following:

In the light of the assurances which the committee has received, and which plainly indicate that more than one interest is prepared to construct and operate rapid transit railroads without calling upon the city to advance its credit in the undertaking to the full extent, or perhaps not to any considerable extent at all, your committee has felt itself justified in laying out a far more comprehensive and elaborate system of lines than it could have ventured to do had the prospects for active competition been less bright.

It has been the effort of the committee to arrange new routes so that each of them should be capable of separate operation and should be practicable to build at once, from engineering, transportation and financial standpoints. It is not expected that the contracts would all be let at once, although the routes might all be approved at the same time. It is impossible for anybody at the present time to form an opinion as to the amount of money which the city may be called upon to furnish for the purposes of the rapid transit extensions now suggested.

By submitting the various routes to competition in turn, beginning with those which seem most urgent, the extent to which the city can undertake additional building will be accurately ascertained.

To a great extent, especially in roads leading into and through Brooklyn, independent lines are proposed by your committee. These will, no doubt, compete to some extent with existing surface or elevated roads, but they will not compete with the municipal railway now under construction. In Manhattan, however, any north and south lines which may be laid out will necessarily be in some degree either extensions of or competitors to the existing subway. It is desirable, on the one hand, to avoid useless duplication of existing transportation facilities. On the other hand, the committee believes that it is essential for the board to avoid laying out lines which only one single bidder could afford to build.

To afford the fullest opportunity for competition between the principal rival interests which have indicated their desire to bid for routes which are in part identical, as in the cases of 7th and Lexington Aves., the committee has pursued the policy of making one route of the part desired by both. Such route may be bid for in combination with other routes in such a manner as to permit both interests to have an equal chance in the bidding. The result is some apparent complexity, but it is believed that a careful study of the lines laid out will show how such combinations of lines can be effected, and the main reasons for the choice of the routes which have been adopted.

Your committee has been strongly urged to recommend to the board the granting of a franchise to the Manhattan Railway Co. for an increase of its facilities along 2d Ave. It is proposed to four-track the elevated road, beginning with about 150th St. and 3d Ave. in the Bronx and thence southerly and along 2d and 1st Aves. in Manhattan to a point near 1st St. At that point it is proposed to divert two of the elevated tracks by passing through private property and thence becoming a subway railroad along Chrystie and Centre Sts. and under Chambers St. to the Hudson River. Your committee does not recommend the grant of such a franchise, which would necessarily have to be perpetual. It thinks it would be inadvisable, because it believes that grants of perpetual franchises should not be made under such circumstances as these.

The routes recommended by the committee are shown on the accompanying maps and are described in the report as follows:

1.—*East Side Route.*—On First Ave. from the Bronx south to the Battery in Manhattan.

Beginning at East 138th St. and Alexander Ave. in the Bronx, running thence southerly a four-track subway under Alexander Ave., through and under the Harlem River to First Ave. in Manhattan, thence continuing under First Ave. to Second St., thence through private property to First St. and private property to Houston St., crossing Houston St. and through private property to Essex St., thence through Essex St. widened, to Hester St. (where a two-track loop will begin, passing through Essex St., East Broadway, Seward Park, crossing Division St. and Hester St.); thence from Hester St. continuing two tracks through Essex St. and Rutgers St. and private property to Madison St., thence through Madison St. to Roosevelt St. and New Bowery, thence through New Bowery to Pearl St., between Dover and Ferry St., thence through private property to Water St., through Water St. to Pine St., through private property to Wall St., through Beaver St. and Bowling Green to Battery Park.

2.—*West Side Route.*—Via Ninth Ave. and Columbus Ave., from Battery Park to West 211th St., all in Manhattan.

Beginning at Battery Park in connection with Route 1, thence through Washington St., a two-track subway to Cortlandt St. (with a loop crossing Liberty St., through private property to West St. to Albany St. and private property, back to and through Washington St. to Cortlandt St.).

Thence a four-track subway through Washington St. to Spring St., thence through private property to Greenwich St. at Vandam St., through Greenwich St. to Ninth Ave., through Ninth and Columbus Aves. to 110th St., thence through Morningside Park to Manhattan Ave. at 111th St., thence through Manhattan Ave., St. Nicholas Ave., Kingsbridge Road and Sherman Ave. to West 211th St.

3.—*East Side Route.*—On Third Ave., from the Bronx south to Battery Park in Manhattan.

Beginning on private property on Southern Boulevard between Third and Lincoln Aves. in the Bronx, thence a two-track subway to and through the Southern Boulevard east to Cypress Ave. (with a spur from Willis Ave. through private property to and through 132d St. to Browns Place), thence through Cypress Ave. and private property to 138th St., thence west on 138th St. and through private property to Lincoln Ave. and under private property to a tunnel under Harlem River, to Borough of Manhattan at Third Ave. and 128th St., thence a four-track subway through Third Ave. to the Bowery at Fifth St., thence through the Bowery at Chatham Square, thence a two-track subway through Park Row, Nassau St. and Broad St. and through private property at Broad and Pearl Sts., to Pearl St., thence through Pearl St. and New Bowery to Chatham Square.

Thence from Broad St. near Pearl St. a two-track subway through Broad St. to South St., through South St. and around the existing subway loop to the terminal yard and station in Battery Park.

4.—*Seventh Ave.*—Route 4 is on 7th Ave. extending from 42d St. to 25th St., either a four-track subway or a two-track subway.

With a four-track subway the route shall be in combination with the following sections, 4 A, 4 B, 4 C and 4 D.

4 A.—Four tracks extending north from 43d St. through 7th Ave. to 59th St., thence under Central Park to 8th Ave. to 62d St., thence through 8th Ave. to 149th St. (thence with a loop through 8th Ave. and private property, 154th St. and private property, and McCoombs Lane southerly to 8th Ave. with a terminal yard within the loop).

4 B.—A four-track extension south from 25th St. through 7th Ave to Greenwich Ave., through Greenwich Ave. to 6th Ave., thence through private property to Washington Square, through Washington Square to West Broadway at 4th St.

4 C.—A four-track subway through West Broadway from 4th St. to Murray St.

4 D.—A four-track subway beginning at Murray St. on West Broadway, thence through West Broadway and Greenwich St. to a terminal station at Battery Park.

Route 4 if for a two-track subway, the route shall be in combination with the following sections, 4 E, 4 C, 4 G and 4 F.

4 E.—Two tracks from 7th Ave. and 25th St. through private property at the N. E. corner of 7th Ave. and 25 St. to 25th St., through 25th St. to Broadway, thence a four-track subway through Broadway, 5th Ave., Washington Square to West Broadway at 4th St.

4 C.—A four-track subway through West Broadway from 4th St. to Murray St.

4 G.—Covers the same route as 4 D. It is, however, a two-track subway with a loop at Battery Park (and also a loop beginning at Murray St. and West Broadway, thence through West Broadway to Barclay St., through Barclay to Greenwich St., thence through Greenwich St. and private property to West Broadway at Murray St.).

4 F.—Beginning at Broadway and 43d St., thence a two-track subway through Broadway to 25th St., connecting with two of the four tracks before described (4E) at this point.

5.—*Lexington Ave.*—Route 5 is for a four-track subway in Manhattan, through Lexington Ave. from 127th St. to 42d St. Route 5 shall include sections 5 A and 5 B.

5 A.—A four-track extension through private property and 42d St., through present subway on Park Ave.

5 B.—A four-track subway north from 127th St. through Lexington Ave to 129th St., and through private property and under the Harlem River, thence through private property, 3d Ave. and Morris Ave. and private property to East 149th St.

Or Route 5 shall be made in combination with sections 5 C, 5 D and 5 E.

5 C.—A two-track subway from 127th St. through Lexington Ave. to 130th St., through private property, thence under the Harlem River and through private property to 3d Ave. to 137th St. (thence a loop through 3d Ave., Morris Ave. to Lowell St. and private property to 142d St., thence through private property to 3d Ave., thence south on 3d Ave. to 137th St.).

5 D.—Commencing at 42d St. and Lexington Ave., thence a four-track subway through Lexington Ave. to 34th St., thence from 34th St. east to 3d Ave. and west to 7th Ave. Also from 5th Ave. at 34th St., a four-track subway south through 5th Ave. to Broadway at Madison Square, thence through Broadway, Union Square, continuing through Broadway to Chambers St., with a loop under City Hall Park, thence from Chambers St., with a two-track subway south on Broadway to Vesey St., west on Vesey St. and through private property to Church St., through Church St. to Greenwich St., through Greenwich St. to a terminal station at Battery Park.

5 E.—A two-track subway from 34th St. and 7th Ave. south on 7th Ave. to a connection with the new Pennsylvania Railroad station on 7th Ave., between 31st and 33d Sts.

6.—*Cross-town.*—A cross-town two-track subway crossing Manhattan through 59th St. from 12th Ave. to terminus of the Blackwell's Island Bridge, thence crossing bridge to Queens.

7.—*Cross-town.*—A cross-town subway from West 23d St. ferry to East 23d St. ferry on 23d St.

8.—*Cross-town.*—A cross-town two-track subway on 14th St. from 11th Ave. to a point between Ave. B and C, where it is proposed to connect with a tunnel under the East River to Brooklyn.

9.—*Manhattan and Brooklyn.*—Beginning at Broadway and Fulton St. in Brooklyn, thence a four-track subway through Broadway to the Brooklyn terminus of the Williamsburg Bridge, thence crossing the Williamsburg Bridge to Delancy St. in Manhattan, thence a four-track subway through Delancy St. and Delancy St. extended, and private property to Centre St., through Centre St. to the proposed new terminal of the Brooklyn Bridge with a spur of two tracks in Walker and Canal Sts., to connect with and cross the Manhattan Bridge, also a cross-town spur through private property and Grand St. through private property and Desbrosses St. to West St. at Desbrosses St. ferry; also from Brooklyn Bridge through William St., a two-track subway to Beekman St. Also a two-track subway in Brooklyn from Broadway and Gates Ave., through Gates Ave. to Bedford Ave., through Bedford Ave. to Lafayette Ave., through Lafayette Ave. to Fulton St.

9 A.—A two-track subway from Bedford and Lafayette Aves., through Bedford Ave. and Bedford Ave. extended to Broadway, connecting with Broadway route at terminal of Williamsburg Bridge.

9 A1.—A two-track subway from Beekman St. through William St., Old Slip and under the East River and private property to Montague St. in Brooklyn, through Montague St. to Fulton St. at Court St.

9 B.—A two-track subway on Fulton St. from Court and Montague Sts. to Willoughby St.

9 C.—A two-track subway through Willoughby St., from Fulton St. to extension of Flatbush Ave., through Flatbush Ave. extension to Fulton St., through Fulton St. to Lafayette Ave.

9 D.—Two additional tracks to present subway (Contract No. 2) on Fulton St., from Joralemon St. to Flatbush Ave., and two additional tracks on Flatbush Ave. to Fourth Ave., and a two-track subway on Lafayette Ave. to Fulton St.

9 E.—Beginning at William and Beekman Sts., a two-track subway through Beekman St. and tunnel under the East River and private propery to Pineapple St. in Brooklyn, thence through Pineapple St. and private property to Fulton St., through Fulton St. to Court and Montague Sts. Also from William St. through Beekman St. to City Hall loop of present subway on Park Row.

10.—*Manhattan and Brooklyn.*—Beginning at Broadway and Union Ave. in Brooklyn, thence through Union Ave. and North 7th St. and through tunnel under East River, to 14th St., in Manhattan, to a connection with Route 8 on 14th St. between Aves. B and C.

11.—*Fourth Ave., Brooklyn.*—The Committee reports that the route should be so laid out that bids may be received for the construction of either a four-track subway or a two-track subway; also that it should be divided into two sections, one extending from Atlantic Ave. to 50th
St., the other from 50th St. to Fort Hail
with a terminal station at Fort Hamilton
sub-divisions of this route under the abo
ditions to be as follows:

On Fourth Ave., a four-track subway
Atlantic Ave. to 50th St.

11 A.—A two-track subway through
Ave. from Atlantic Ave. to 50th St., to
constructed that in the future two ad
tracks may be added.

11 B.—Beginning at 50th St. and Fourt
a four-track subway through Fourth Ave.
Hamilton with a terminal station at Fort
ilton.

11 C.—A two-track subway through
Ave. from 50th St. to Fort Hamilton
terminal station at Fort Hamilton; to be
structed that in the future two additional
may be added.

11 D.—Beginning at Court and Montag
a two-track subway through Court St. to
Ave., thence through Atlantic Ave. to
Ave. at Flatbush Ave.

11 E.—Beginning at Fourth and Flatbus
a two-track subway passing under the
subway to Flatbush Ave. extension of th
hattan bridge, through Flatbush Ave. exten
and crossing Manhattan Bridge to Canal
Manhattan.

12. *Eastern Parkway, Brooklyn.*—A tw
subway from the Circle at Flatbush Ave.
Eastern Parkway and Pitkin Ave. and
property to Georgia Ave., thence through
Ave. and private property to Broadway at
St.

13. *Jamaica Ave., Brooklyn.*—Beginni
junction of Broadway and Fulton St. and J
Ave., thence a four-track subway through J
Ave. to Jamaica at Maple Ave.

14. *West Side, The Bronx.*—An extens
the present West Side line of the Rapid
elevated road with three tracks from King
at 230th St. and Broadway, through Br
to a terminal at Van Cortlandt Park.

15. *The Bronx.*—Beginning at termin
Eighth Ave. division of Manhattan Ry. at
St., thence crossing the Harlem River wi
tracks on a bridge, thence continuing two
beneath the ridge under 161st St. to Jerom
thence an elevated three-track railroad on
Ave. to its intersection with Gerard A
Clark Place.

15 A.—From 154th St. and Eighth Ave.
track subway under private property a
Harlem River to the Bronx, thence und
vate property and 161st St. a two-track
to Jerome Ave., thence through Jerome
four-track subway to Woodlawn.

15 B.—From 154th St. and Eighth Ave.
track subway and tunnel through private p
to and under the Harlem River to the
thence northerly under private property to
Bridge.

16. *The Bronx.*—A three-track elevate
on Jerome Ave., from Clark Pl. to Wood

17. *The Bronx.*—A two-track subway
ning at 138th St. and Third Ave., thenc
through 138th St. to Gerard Ave., throug
ard Ave. to Jerome Ave. at Clark Pl., w
may be connected with the proposed Rou
16.

18. *The Bronx.*—Beginning at 177th
West Farms Rd., thence a three-track el
road on West Farms Rd. to Morris Park
thence on Morris Park Ave. and White
Rd. to Wakefield at E. 233d St.

19. *The Bronx.*—Beginning at Cypress
and 138th St., a three-track elevated roa
on 138th St. to Southern Blvd., thence on
ern Blvd. to Westchester Ave., thence on
chester Ave. to the Village of Westches
Williamsbridge Rd.

BUSINESS NOTES.

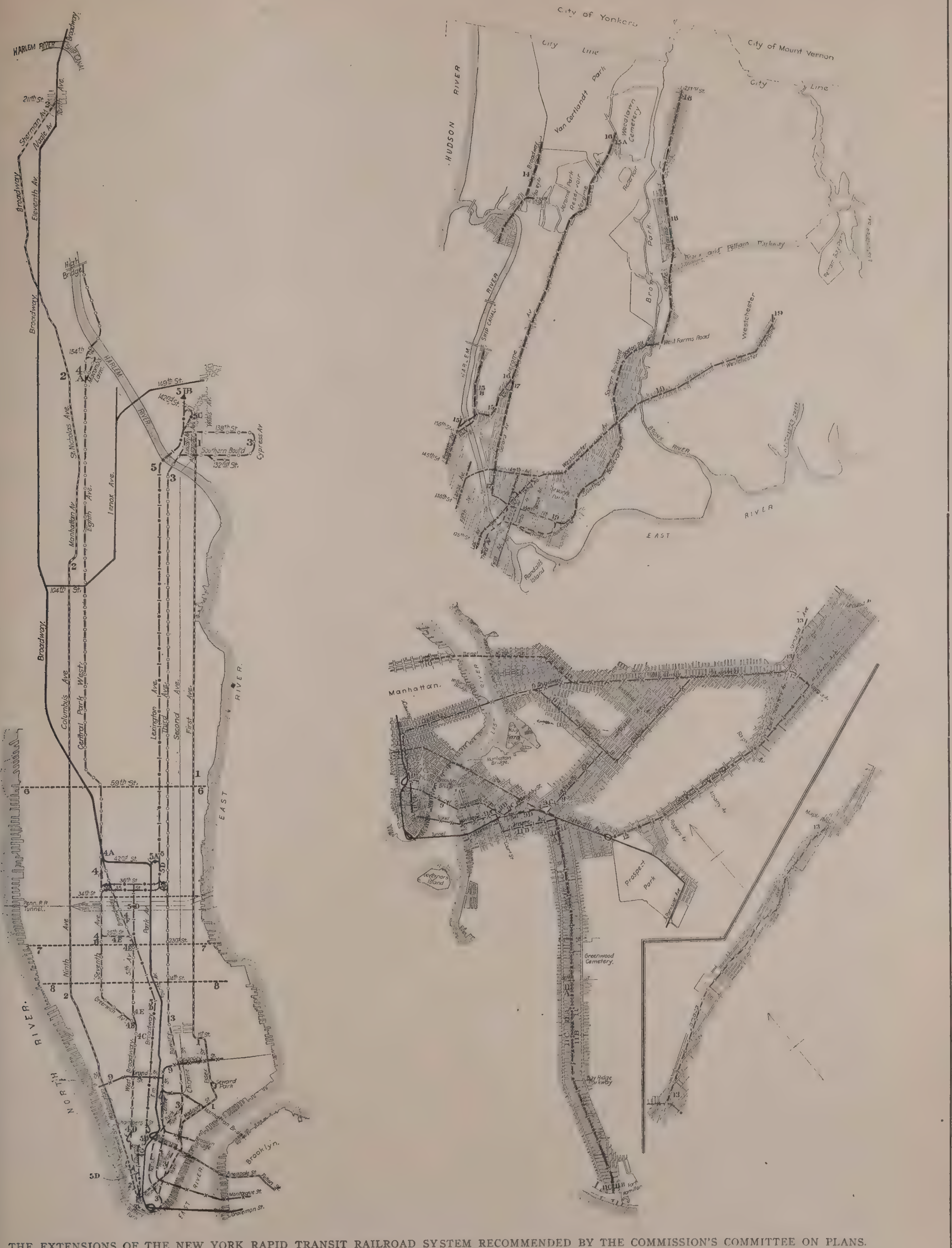
The New York Contracting Co. has be
corporated with $100,000 capital, to make
York, New Haven & Hartford R. R. im
ments. The directors are John J. Murp
I. Gaffney and Geo. H. Allison, all of
York.

Fred T. Ley & Co. have incorporated
a capital of $100,000, as contractors and bu
Harold A. Ley, Springfield, Mass., pres.;
T. Ley, Springfield, treas. and clk.

The Otis-Fensom Elevator Co., Toronto,
has new factories under construction in
ton, Ont. The power plant to be install
been purchased.

The Haberkorn Engine Co., Fort W
Ind., has sold to the Litchfield Foundry
chine Co., of Litchfield, Ill., the right to
facture stationary engines with the Hab
patent valve and valve gear. The comp
now arranging to dispose of the rights f
use of these patents in the East.

The Department of Commerce and Lab
published as No. 2204 of "Daily Consul



THE EXTENSIONS OF THE NEW YORK RAPID TRANSIT RAILROAD SYSTEM RECOMMENDED BY THE COMMISSION'S COMMITTEE ON PLANS.

ports" a list of the textile mills in India, China, Japan and Russia. It gives the name and location of each mill, the name and address of the owners or agents, and the number of spindles and looms. The value of such a list to American manufacturers of textile mill supplies desirous of doing business in those countries is manifest.

The C. O. Bartlett & Snow Co., Cleveland, reports the following among recent sales: Rockefeller Bldg., Cleveland, ash and cinder elevator; Ohio Retarder Co., Port Clinton, Triumph steam dryer; Western Ore Separating Co., Salt Lake City, Utah, direct heat rotary dryer; Henrietta, Ariz., Cyanide & Dev. Co., direct heat rotary dryer; Grasselli Chemical Co., Cleveland, large conveying outfit; Standard Oil Co., Cleveland, conveying outfit; Iroquois Portland Cement Co., Caledonia, N. Y., two direct heat rotary dryers; National Mining Co., Pittsburg, large conveying outfit with capacity of 175 tons of coal per hour; I. E. Boomer, Detroit, Triumph sand and gravel digger, elevator and grader for elevating and grading 40 yd. per hour; Royal Crown Lead Co., Detroit, paint machinery; Wm. Allerdice & Son, Saratoga Springs, N. Y., C. Schmidt & Co., Cincinnati, and Croninger Packing Co., Shamokin, Pa., fertilizer dryers; Glidden Varnish Co., Cleveland, and Shoab Paint Co., Wellsville, O., paint machinery; Cameron & Barkely, Charleston, S. C., conveying and elevating machinery; Sandusky, O., Portland Cement Co., No. 3 direct heat rotary dryer for drying 10 tons of crushed rock per hour; E. H. Alverd, Marble Mount, Wash., paint machinery; Ross Keller Triple Pressure Brick Machine Co., St. Louis, Mo., crushing, conveying and sand-mixing machinery; Hudson, N. Y., Portland Cement Co., and Belleville, Ont., Portland Cement Co., Portland cement machinery; Crescent Portland Cement Co., Wampum, Pa., feeders and Portland cement machinery; Brighton Chemical Co., New Brighton, Pa., elevating and mixing machinery; American Iron & Steel Co., Lebanon, Pa., coal conveyors; Guignard Brick Works, Columbia, S. C., sand and clay dryers. The company is also receiving many other small orders from all sections of the country and quite a number of inquiries from foreign countries.

Concrete chimneys seem to be growing rapidly in favor, judging from the business in hand of the Weber Steel-Concrete Chimney Co., 159 La Salle St., Chicago. It is now completing a 200x12-ft. stack for the Consumers' Electric Co., of New Orleans; a 230x12-ft. stack for the Portland General Electric Co., Portland, Ore.; a 300x18-ft. stack at Tacoma, and 13 stacks for the Prairie Oil & Gas Co. It has just closed contracts for seven stacks for one company.

Orders recently placed by the Philadelphia Rapid Transit Co. and the United Electric Light Co., of Springfield, Mass., are evidence that turbo-generators are successful. Both of these companies have been operating units of this type, and as soon as they can be built the former will install two Westinghouse 1,500-kw., 13,200-volt, turbine-driven generators, and the latter company a 1,000-kw. unit of the same type. Three of these outfits have recently been ordered by the Public Service Corporation of New Jersey, one having an output of 500 kw. and two with ratings of 1,000 kw. each. There is also a 1,000-kw. turbo-generator building for the Indian Orchard Co., and a 400-h.p. induction motor with starting device, and two 300-kw. transformers. Westinghouse, Church, Kerr & Co. are the designers and engineers for this station.

The Truckee River General Electric Co., of California, operating many high potential lines, will add a 2,000-kw. alternating-current belt-driven generator, four 750-kw. and four 625-kw. transformers to their present equipment. Westinghouse low equivalent lightning arresters and choke coils are being used for the protection of apparatus, and more will be added.

Allis-Chalmers Co. is removing its general offices from Chicago to Milwaukee. This is another step in the direction of carrying out the plans of the present administration, which are gradually being brought to completion. One of the first conclusions arrived at by President Warren, after assuming office a year ago, was that for every reason connected with efficient administration of all branches of the work, from designing to manufacturing, and from selling to collecting and accounting, the chief offices of the company, covering all the ramifications of its business, should be concentrated in one place. That place was logically Milwaukee; because, although the company has four other works in three other cities, the largest works are in Milwaukee, and Milwaukee is where all the future expansion of the company's operations will take place. Besides, at the Milwaukee suburb of West Allis it has the land to build upon. Instead of handling the several departments at long range, as under the old system, they will all be concentrated in one place, thus eliminating the necessity for constant traveling to and fro, effecting a great saving in time and expense, an enormous reduction in correspondence and, above all, the quickening of all movements of production. Only by concentration at the strategic point can the results that have been aimed at by the president be accomplished. Plans for the workshop extensions at West Allis, which involve the construction of several more units, are practically complete, and the extensions will be made in due course.

The Nurnberg Works in Germany desire it to be known that they use for their steam engines a trip valve gear in accordance with their own patents (Marx gear). For their gas engines they also use their own patent gear, which works as follows: The cut-off of the valve always takes place at the same time while the valve opens at different periods, i.e., at full load sooner, at small load later. If the engine is entirely unloaded the opening of the valve takes place at such a late period that it coincides with the cut-off, so that the valve remains shut altogether the opening point only is therefore controlled by the governor while it exercises no influence upon the cut-off mechanism.

The Milford Pink Granite Co., the properties of Norcross Bros., and the G. H. Cutting Granite Co., of Milford, Mass., have been consolidated in the Milford Pink Quarries Co., which already has a number of large contracts on hand.

The last official act of the late members of the Isthmian Canal Commission before resigning was to close a contract with the Ingersoll-Sergeant Drill Co., of New York, for 50 standard rock drills of that company's manufacture, complete with mountings and equipment. These machines are to be used in the removal of rock in the great Culebra cut through the crest of the Isthmus. The Commission furthermore authorized the same company to remodel a large number of the French-Ingersoll drills, built in France under the patents of the American manufacturers. These machines remain from the original equipment of the old French Company formerly operating on the canal. The fact that the old drills are still in a condition to justify their use indicates the merit of machinery of American type and design.

A few weeks ago it was announcd in this journal that Mr. Gardiner C. Sims had acquired an interest in the Marine Engine & Machine Co., of Harrison, N. J., and would become its general manager. The company has all the drawings and patterns of the later types of the well-known Armington & Sims high, medium and slow-speed engines, and is now building them under the personal direction of Mr. Sims. They will be built in sizes ranging from 10 to 3,000 h.p., and in horizontal and vertical types, side and center crank, single and in pairs, simple and non-condensing, all speeds, with both single and Corliss valves. Upwards of 6,000 of these engines have been built, and the completion of arrangements for continuing their manufacture under Mr. Sims' supervision is an important industrial event.

PERSONAL NOTES

Mr. F. C. Schmitz will present a paper on "The Fireproofing of Framed Structures," April 13, before the Brooklyn Engineers' Club.

Mr. Frank Shutts has moved his offices from the Van Phul & Gordon Bldg. to the Kaufman Bldg., Lake Charles.

Mr. A. N. Johnson, chief engineer of the division of highways of the Maryland Geological Survey, has resigned his position to accept that of highway engineer of the U. S. Office of Public Roads.

Mr. C. E. Grunsky, who recently resigned from the Isthmian Canal Commission, has been appointed consulting engineer to the U. S. Reclamation Service.

Messrs. Willard P. Adden and Winthrop D. Parker have formed a partnership under the firm name of Adden & Parker, architects, 12 Bosworth St., Boston, Mass.

Mr. John D. Twiggs, Jr., city engineer of Augusta, Ga., has been appointed chief engineer of an electric railway to be built at once between Raleigh and Durham, N. C.

Mr. H. B. Reed has resigned as division engineer of the Rapid Transit Subway Construction Co., of New York, to accept a position with Mr. John B. McDonald.

Messrs. J. C. Motley and P. L. Dryer, civil and mining engineers of Birmingham, Ala., have formed a partnership to do a general engineering business, with headquarters in Birmingham.

Mr. H. A. Comstock, engineering aid in the U. S. Reclamation Service, has been assigned to hydrographic work in South Dakota, and ordered to report to Mr. Raymond F. Walter at Belle Fourche.

Mr. Thomas Appleton, superintendent of construction of the new Holyoke, Mass., post office, has been appointed superintendent of construction of the government building at Wheeling, W. Va.

Maj. David DuB. Gaillard, Corps of Engineers, U. S. A., has been detailed by the President as a member of the General Staff, succeeding Maj. Edward J. McClernand, who has been promoted to the grade of lieutenant colonel.

Dr. Edward B. Ellicott, for eight years at the head of the municipal electrical department in Chicago, has been made principal engineer of the Chicago drainage canal, and will be in charge of the water-power on the canal.

Arthur S. Ives, for some years in charge of the centrifugal pump department of R. D. Wood & Co., of Philadelphia, resigned March 1 to become assistant general manager of the Glamorgan Pipe & Foundry Co., Lynchburg, Va.

Mr. Chas. H. Williams, formerly with the Madison, Wis., Gas & Electric Co., and president of the Northwestern Electrical Association, has joined the Wisconsin Light & Power Co., of La Crosse, as general manager.

Mr. Thomas H. Humphreys has been promoted from the position of assistant engineer to that of engineer in the U. S. Reclamation Service, and assigned to work at Klamath Falls under Supervising Engineer J. B. Lippincott.

Mr. Jacob J. Haarer has been appointed commissioner of public works, Mr. Robert E. Bolger has been reappointed park commissioner, and Mr. Theodore H. Hinchman, Jr., has been named as lighting commissioner of Detroit, Mich. Mr. Hinchman is a member of the well-known engineering firm of Field, Hinchman & Smith.

Mr. John C. Avakian, of California, has received an appointment as assistant engineer in the U. S. Reclamation Service, and assigned to work in California under the direction of Supervising Engineer J. B. Lippincott, of Los Angeles.

Mr. John C. Cleghorn, of Iowa, has received an appointment as engineering aid in the U. S. Reclamation Service, and ordered to report to S. B. Robbins, Great Falls, Montana, where he will be engaged in work on the Sun River project.

Mr. John T. Keenan, of Colorado, has been appointed assistant engineer in the U. S. Reclamation Service. Mr. Keenan will engage in work on the Uncompahgre Valley project at Montrose, Colo., under the direction of I. W. McConnell.

Lieut.-Col. Wm. H. Bixby, Corps of Engineers, U. S. A., has been transferred to Chicago to relieve Col. O. H. Ernst, who has been appointed a member of the Isthmian Canal Commission, and Major Charles H. Ricke, who goes to Rock Island.

Mr. H. H. Wadsworth, assistant engineer under Major Charles L. Potter, Corps of Engineers, U. S. A., has removed from Duluth, Minn., to San Francisco, Cal., to become assistant engineer to the Debris Commission, which has charge of regulating placer mining operations in California.

Mr. F. C. Batchelder, superintendent of the Newark division of the Baltimore & Ohio R. R., has been promoted to superintendent of the Chicago division, succeeding Mr. J. A. Spielman, who will probably be transferred to the position of division engineer of the Chicago division.

Mr. Elver L. Shinhur, of Colorado, has received an appointment as engineering aid in the U. S. Reclamation Service, and ordered to report to I. W. McConnell at Montrose, Colo., where he will be engaged in connection with the Uncompahgre Valley project.

Mr. Chas. A. G. Winther has resigned as general superintendent of the Chapman Valve Co.'s factory at Indian Orchard, Mass., a position he had held for 4 years. Prior to his connection with the Chapman Valve Co., Mr. Winther was for 15 years superintendent of the Star Brass Mfg. Co., of Boston, and previous to that was with the Crosby Steam Gage & Valve Co. for 8 years.

Mr. George A. Lederle, of Christie, Lane & Co., the firm which is constructing the government canal near New Orleans, died March 28 in New Orleans. Mr. Lederle was graduated from the University of Michigan with the class of 1884, and had been prominently identified with several large engineering projects in the West and South.

Mr. O. E. Goldschmidt, formerly engineer in charge of steam work with the Geo. A. Fuller Co., and Mr. W. W. Haney, formerly with the
New York Edison Co., have joined th
ing staff of Mr. Henry Floy, of New Y

An examination of candidates for t
of topographic draftsmen in the Pan
service will be held in the principal cit
country, May 3 and 4, by the U. S.
vice Commission. An examination to
list of eligibles for the position of in
construction in the Quartermaster's I
at Large, Boston, Mass., will also be he

Mr. F. C. Herrman, assistant city e
San Francisco, Cal., has resigned to
position of irrigation engineer in the
partment of Agriculture. His work
vestigating the methods of irrigating
in Colorado and adjacent States, and
most economic use of water for irrigati
eral agriculture.

Messrs. A. C. Bunker and W. C.
alternating-current engineers, have be
ciated with the engineering and contr
ments, respectively, of the Crocker-W
Ampere, N. J. Mr. Bunker has been
with the Stanley Electric Mfg. Co. on
coast. Mr. Appleton has acted as
salesman for the General Electric Co.
lanta territory.

Mr. J. W. Stearns has been appoin
ant city engineer of Indianapolis, Ind.,
of railroad track elevation work. M
was formerly connected with the New
Haven & Hartford R. R. in track eleva
and has more recently been engaged
tensive realignment and grade reduc
which the Big Four R. R. has been c
in Indiana and Illinois for the past tw

Mr. C. C. Conkling, chief enginee
Lackawanna Steel Co. and of the Sou
Ry., has resigned to take up a general
practice in Buffalo, N. Y., but will b
as consulting engineer of the steel com
Conkling has been with the Lackawa
Co. since 1886, having become connect
while the plant was at Scranton, Pa. M
Hutchinson has been placed in charge
engineering work under the direction o
General Superintendent Barr, and M
Hamilton will supervise the civil engir
fice work connected with the plant.

The first award of the John Fritz
been made to Lord Kelvin for "cable
and other general scientific achievemer
award was made by the following m
the four engineering societies: Am. S
—Robert Moore, Alfred Noble, Chas
Hunt, Chas. Hermany. A. I. M. I
Spilsbury, James Douglas, Charles Kir
E. Olcott. Am. Soc. M. E.—John
Robt. W. Hunt, S. T. Wellman, James
A. I. E. E.—Carl Hering, Chas. P.
Chas. F. Scott, B. J. Arnold. The m
was provided by the friends of John
his eightieth birthday to perpetuate th
of his achievements in industrial prog

Mr. W. L. Derr, superintendent of
quehanna division of the New York,
& Western R. R., has been appointe
superintendent at Hartford, Conn., of
York, New Haven & Hartford R. R.,
Mr. G. H. Wilson, who has resigned
business in New York City. Mr. De
civil engineering in the office of the
Larkin, engineer of the Susquehanna
Havre de Grace, and entered railway
1877 in the maintenance of way depa
the Pittsburg, Chicago & St. Louis Ry
came connected with the engineering d
of the New York & New England Ry.
and left the position of assistant to su
ent on that road in 1886 to become r
on the Erie, rising from the latter posit
one from which he has just resigned.

George A. Marr, U. S. superinten
assistant engineer, Portage Lake ship ca
March 24, at Chicago. He was born i
was graduated from the University of
in 1862, and received the degree of C
neer from the same institution in 1863
degree of Master of Science in 1867. H
a member of the American Society of
gineers in 1883. Mr. Marr was employ
U. S. Lake Survey first in 1861-62 in so
capacity, and as assistant engineer in
Afterwards he was assistant enginee
U. S. surveys and improvements of the
River and the upper portion of the M
River, and from 1891 to the date of h
was superintendent and assistant
Portage Lake ship canals, at Hought
therefore, was engaged for 44 years o
ment engineering work, which is believ
a longer period than that of any other
the Great Lakes. His age was about
At the time of his death he was return
a trip to Mexico, which was taken for h

TRACTING NEWS
OF SPECIAL INTEREST TO
RACTORS, BUILDERS, ENGINEERS
AND MANUFACTURERS
NEERING AND BUILDING SUPPLIES.

WATER.

Arranged Alphabetically by States.

lle, Ala.—See "Power Plants, Gas and y."

Ingeles, Cal.—See "Public Buildings."

Diego, Cal.—G. A. d'Hemecourt, City rites that plans are being prepared for truction of a pumping station in Mis- ley, to cost $35,000.

land, Cal.—The Town Trus. are stated decided to construct water works.

na, Cal.—The citizens are reported to ed Mar. 25 to issue $931,250 bonds for chase and development of the water

Rosa, Cal.—See "Schools."

y, Cal.—It is reported that bids will ed May 2, by the Bd. of Supervis., at eles, for constructing a pumping plant, foundation, on the Los Angeles County ear Downey. C. G. Keyes, County Clk.

uan, Cal.—An election will probably held to vote on issuing $6,000 bonds construction of water works.

ock, Colo.—Douglas County Ditch & Co. is reported incorporated with of $150,000, by Charles H. Ellis, John ay, R. J. Dobell and others. The com- s secured two reservoir sites, one in anon and another south of the Santa e at Larkspur, covering 200 acres. The ill be walled and the reservoir thus will hold 1,000,000 cu. ft. of water.

gton, D. C.—See "Power Plants, Gas tricity."

ouse, Ill.—Owen Ford, Security Bldg., is reported to have completed plans works for Roodhouse.

on, Ind.—The question of installing a nt here is reported under considera-

apolis, Ind.—Local press reports state s have been completed by the Indianap- er Co. for the building of covers over filter beds; estimated cost of work,

an City, Ind.—It is reported bids are Apr. 17 for 11,000 ft. of 6 to 12-in. pe and specials. Edw. J. Heise, City

Falls, Ia.—F. E. Foster, City Clk., at the contract for furnishing material tructing a complete pumping plant for works (bids opened Mar. 6) has been to the Western Steel Constr. Co., of nes, for $7,550.

urg, Ia.—D. G. Files, Town Clk., at it was voted Mar. 27 to construct rks.

oxie, Kan.—E. F. Coolidge, City Clk., at it was voted Apr. 3 to issue $12,000 water works. Engineers Burns & Mc- Kansas City, Mo.

gton, Kan.—It is stated that bids will ed until Apr. 20 by J. Q. Ragan, City furnishing material and constructing orks; also for the construction of a , 16x100 ft.

w, Ky.—A. A. Holbrook is reported purchased the water works and will make some improvements.

lle, La.—See "Power Plants, Gas and y."

ce, Mass.—The search for an additional pply by a system of driven wells has ndoned, a sufficient supply not having covered. The original plan of a cov- d filter will probably be taken up im- .

, Mass.—S. W. Armington, Town ites that the contract for constructing orks has already been awarded. The recently voted to issue $50,000 bonds r this work.

, Minn.—See "Power Plants, Gas and y."

le, Minn.—It is reported bids will be Apr. 20 by W. H. Kiley, Village Re- or 1,530 ft. of 6-in., and 180 ft. of er pipe; four 4-in. hydrants, gate valves es, etc.

me, Minn.—It is reported Chas. Field, Recorder, will receive bids Apr. 15 for ing water works.

, Minn.—The Village Council is re- have decided to make extensive addi- the water works.

, Miss.—See "Power Plants, Gas and y."

nsburg, Miss.—Press reports state bids received Apr. 18 for $14,000 bonds to to construct water works.

een, Miss.—Contracts for constructing rks and a sewerage system are reported to have been awarded as follows: Powerhouse and reservoir, S. H. Berg, Aberdeen. Corliss engine, Allis-Chalmers Co., Milwaukee, Wis. Laying water mains, T. J. Byrne, St. Louis, Mo. Laying sewer pipes, Sullivan & Long, Bessemer, Ala. Elevated tank, Chicago Bridge Wks., Chicago, Ill. Cast iron water pipes, U. S. Cast Iron Fdy. Co., Chattanooga, Tenn. Pumps, McGowan Pump Co., Cincinnati, O. Hydraunts and valves, Rensselaer Mfg. Co., Troy, N. Y. Boilers and heater, Walsh & Weidner Boiler Co., Chattanooga, Tenn. Total cost, $73,500.

Glendive, Mont.—Bids will be received at the office of the U. S. Reclamation Service, Glendive, on June 1, for the construction of about 34 miles of canal, near Glendive, with headworks, conduits, spillways, etc., as advertised in The Engineering Record.

Ft. Dodge, Neb.—See "Power Plants, Gas and Electricity."

Wilton, N. H.—See "Sewerage and Sewage Disposal."

Wilton, N. H.—Bids will be received until Apr. 20 by the Com. on Sewers (L. S. Whiting, Chmn.), for laying about 18,500 ft. of sewer pipe and appurtenances and about one-half mile of water pipe.

**Atlantic City, N. J.*—Kenneth Allen, Engr. and Supt. Water Wks., writes that the contract for coal pocket, coal elevating machinery and a machine shop and tool house (bids opened Mar. 28) has been awarded to W. W. Lindsay & Co., Harrison Bldg., Philadelphia, Pa., for $8,880.

Highlands, N. J.—See "Power Plants, Gas and Electricity."

Brooklyn, N. Y.—The Highway Comrs. at Hempstead are reported to have granted the Borough of Brooklyn permission to establish a filtration plant near its pumping station at Bellmore.

North Hempstead, L. I., N. Y.—Bids will be received until Apr. 12 by Monroe S. Wood, Town Clk. of N. Hempstead, at Roslyn, for the supply of water by means of street hydrants, along the public highways, streets and avenues of the Great Neck Water Supply Dist., within said town. Hydrants to be not less than 50 in number, and water is to be furnished through said hydrants for fire, sanitary and other purposes.

Plattsburg, N. Y.—Thos. F. Manix, City Clk., writes that it is proposed to construct a storage reservoir and substitute iron for cement mains; probable cost of work, $50,000. No engineer engaged as yet.

Saranac Lake, N. Y.—The State Senate is reported to have passed a bill providing for the issue of bonds for improving the water works and sewerage system.

West Winfield, N. Y.—The citizens are reported to have voted Mar. 21 to lay a system of water mains for fire protection.

Victor, N. Y.—The citizens are reported to have voted to issue $2,000 bonds for the purpose of piping Main St. Victor hopes to gradually install water works which will supply the whole village within the next few years at a total cost of about $20,000.

Oswego, N. Y.—Bids will be received by the Dept. of Water, Apr. 15, for furnishing and delivering c. i. pipe and special castings for the Lake water extension, as advertised in The Engineering Record.

West Point, N. Y.—Bids will be received by the Quartermaster U. S. A., May 5, for furnishing about 3,000 tons c. i. pipe and special castings, as advertised in The Engineering Record.

Binghamton, N. Y.—There is reported to be a movement on foot here to construct a reservoir to cost $400,000. John Anderson, Sec'y, Water Board.

Roseville, O.—The Muskingum Water Supply Co. is reported incorporated with a capital of $10,000 by C. U. Shryock and E. A. Palmer, of Zanesville, J. W. McCoy, of Roseville, and G. E. McKeever, of Crooksville, to supply water from Muskingum River to Roseville, Crooksville and other towns, mines and railroads.

Canton, O.—C. A. Zellers Clk. Bd. Pub. Service, writes that the following are the bids opened on Apr. 3 for (*a*) pumping station, (*b*) stack (bidders of Canton unless otherwise mentioned): Jos. J. Streb, *a* $24,999; Keller E. Huff, *a* $26,946. A. Castell & Co., *a* $28,963, *b*, $5,000. Melbourne Bros., *a* $24,200, *b*, $6,500. Geo. A. Whike, *a* $24,888, *b* $4,455. C. M. Kilgore & E. J. Landar, *a* $29,250. Wm. Shaaf, *b* $3,490. M. W. Kellogg & Co., New York, N. Y., *b* $4,486. Alphons Custodes, Chimney Constr. Co., New York, *b* (two bids) $4,775 and $5,150, and Weber Steel Concrete Chimney Co., Chicago, Ill., *b* $4,400.

Cincinnati, O.—Bids will be received until May 2 by the Bd. of Trus., Comrs. of Water Wks. (Aug. Herrmann, Pres.) for laying c. i. pipe, special castings and valves and other miscellaneous work in connection therewith, for the extension and betterment of the water distribution system. The aggregate length of the main to be laid is about 5,035 lin. ft. 16 and 24-in. c. i. pipe.

Belpre, O.—See "Power Plants, Gas and Electricity."

Cleveland, O.—The Council Com. on Finance is stated to have approved ordinances to expend $15,000 for the purchase of two new water tube boilers for the Kirtland pumping station; $9,000 for the erection of the superstructure of a temporary engine house at the station, and $12,850 for the making of delinquent sewer and water house connections.

The City Council on Apr. 3 passed ordinances authorizing an expenditure of $15,000 for water pipe boilers and $16,000 for dredging.

An ordinance was introduced in Council, Apr. 3, authorizing the Bd. of Pub. Service to expend $100,000 for c. i. pipe for the Water Works Dept.

**Philadelphia, Pa.*—Henderson & Co., 1221 Arch St., are stated to have secured the contract for a coal-handling plant at the Lardner's Point filtration station at Torresdale (bids opened Feb. 2). The plant will be of structural steel and will consist of coal pockets, trestles and electric apparatus. For list of bids received for this work see issue of The Engineering Record, Feb. 11.

Lower Brule, S. D.—Bids will be received Apr. 25 by F. E. Leupp, Commissioner of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material and constructing a water tank and tower at Lower Brule Agency Boarding school. P. H. Somers, Indian Agent, Lower Brule.

Frederick, S. D.—The citizens are reported to have voted to issue $4,000 bonds for water works.

Shelbyville, Tenn.—See "Power Plants, Gas and Electricity."

Uvalde, Tex.—Richard H. Phillips, Consulting Engr., Security Bldg., St. Louis, Mo., has been retained to make report on method of procuring water supply and cost of same for irrigating 36,000 acres of land in Uvalde County for A. D. Evans and others, supply to come from headwaters of Blanco River; gravity flow to the land, some 5 miles south.

Galveston, Tex.—Rudolph Herring, New York, N. Y., is reported to be investigating the water supply of Galveston, with a view to improving same.

Jacksonville, Tex.—An election will probably soon be held to vote on issuing bonds for water works.

**North Ft. Worth, Tex.*—The contract for the construction of waterworks is reported to have been awarded to the McQuatters Machine & Plumbing Co., Hillsboro, Tex., for $92,980.

Quanah, Tex.—Cecil A. Lyon, of Houston, writes that he, with J. S. Rice, also of Houston, are interested in the construction of an irrigation system near Quanah. About 4,000 to 5,000 acres of land will be irrigated and the investment will be about $250,000. They wish to correspond with grading contractors, who wish to figure on the construction of a dam, which will contain about 160,000 to 170,000 yds. of earth. The dam will be about one mile long, 30 ft. high. Bids to be in about Apr. 15, and contract awarded about May 1. They also want prices on 36-in. c. i. pipe and gate valves. For futher information, address Cecil A. Lyon, of Houston, engineer; J. W. Field, Wichita Falls, Tex.

Panguitch, Utah.—See "Schools."

Northfield, Vt.—J. M. Holland is reported interested in the construction of water works.

Fredericksburg, Va.—See "Power Plants, Gas and Electricity."

Ft. Casey, Wash.—Capt. Geo. H. Penrose, Q. M. U. S. A., Port Townsend, writes that the following are the bids opened on Mar. 24 for a water supply system for Ft. Casey: (*a*) boiler and pump house (*b*) caisson wells (*c*) tank and trestle; (*d*) boiler and pump; (*e*) 10,550 ft. of water main; (*f*) total: P. S. Bridge & Dredging Co., Seattle, *c*, $11,237. Chas. M. Maxwell, Seattle, *b*, $6,086; *c*, $9,861; *d*, $5,190; *e*, $12,751. Jacobsen-Bade Co., Portland, Ore., *a*, $3,100; *b*, $8,000; *c*, $10,000; *d*, $2,500; *e*, $12,417; *f*, $36,017. McInnis & Cotton, Port Townsend, *a*, $2,520; *b*. $3,313; *c*, $6,650; *d*, $4,677; *e*, $12,544; *f*, $29,704. Pacific Iron & Steel Wks., Seattle, *a*, $4,158; *b*, $2,294; *c*, $11,939; *d*, $4,679; *e*, $10,182; *f*, 30,718. Burrell Constr. Co., Seattle, *a*, $3,172; *b*, $3,970; *c*, $9,551; *d*, $2,293; *e*, $12,765; *f*, $31,751. International Constr. Co., Seattle, *c*, $12,740. Hurley & Co., St. Paul, Minn., *a*, $3,216; *b*, $7,784; *c*, $13,444; *d*, $7,104; *e*, $15,423; *f*, $45,970. Dwyer Plumbing & Htg. Co., St. Paul, Minn., *b*, $5,285; *d*, $5,940; *e*, $13,500. McInnis & Hargton, Port Townsend, *a*, $2,560; *b*, $2,800; *c*, $8,500; *d*, $4,400; *e*, $9,395; *f*, $27,655. Loren Seward, Portland, Ore., *a*, $4,672; *b*, $3,950; *c*, $13,845; *d*, $4,994; *e*, $11,878; *f*, $39,339.

Seattle, Wash.—The lowest bid opened on Mar. 25 for laying a water main on East Cherry St. and 29th Ave., was submitted by the International Contract Co. for $8,500.

A correspondent writes that bids will be received by C. B. Bagley, Sec'y Bd. Pub. Wks., on either Apr. 8 or Apr. 15 for constructing a water main on Western Ave., at an estimated cost of $95,500, to consist of 10,850 lin. ft. 20-in c. i. pipe; 15,000 lin. ft. 20-in. wood pipe; 25 20-in. gates; 2 10-in. gates; 2 8-in. gates; 2 6-in. gates; 25 hydrants and 65 M. ft. lumber.

Sumas, Wash.—See "Power Plants, Gas and Electricity."

Berkeley Springs, W. Va.—See "Power Plants, Gas and Electricity."

Prince Albert, N. W. Ter.—The citizens are reported to have voted Mar. 29 to issue $160,000 bonds for water works, a sewerage system and for sidewalks.

Winnepeg, Man.—City Engr. Ruttan is reported to have recommended the laying of an 18-in. water main on McPhillips St. at a cost of about $18,000.

City Engr. Ruttan is reported to have estimated the cost of high-pressure water works for Winnipeg at $380,000.

North Bay, Ont.—L. O. Clark, Town Engr., writes that the following are the bids opened on Mar. 20 for (*a*) laying 15,000 lin. ft. 10-in. c. i. water main, (*b*) for rock (extra) per cu. yd. in a 3-ft. wide trench. Pipe supplied by the town: Jas. M. Chalmers, Lindsay, *a*, 47¼ cts.; *b*, $3.89. J. F. Connolly, Toronto, *a*, 48 cts.; *b*, $5. Constr. & Paving Co., Toronto, *a*, 82 cts.; *b*, $5.50. O'Boyle Bros., Sault Ste. Marie, Ont., *a*, 62 cts.; *b*, $3.50. J. L. Morris, Pembroke, *a*, 50 cts.; *b*, $3.67. Fraser-Ward & Co., Niagara Falls South, Ont., *a*, 57 cts.; *b*, $4.50. Leeney & O'Mara, Pembroke, *a*, 46⅔ cts.; *b*, $4. Lowry & Murphy, Ottawa, *a*, 44¼ cts.; *b*, $3.75. Thos McLaughlin, Galt, *a*, 75 3-5 cts.; *b*, $4. Newman Bros., Windsor, *a*, 39 cts.; *b*, $4.50.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

San Francisco, Cal.—The Bd. of Superv. is stated to have passed an ordinance providing for the construction of concrete sewer in Mission St., to cost $15,000.

**Los Angeles, Cal.*—The Sewer Com. is stated to have recommended to Council the bid of Hickox & Martin for building a storm drain on 2d St., Stephenson Ave. and 4th St. to Los Angeles River for $39,320.

Santa Rosa, Cal.—See "Schools."

New Britain, Conn.—This city will let by contract during the month of May sewer work to cost from $50,00 to $100,000. For further information address Wm. H. Cadwell, Engr., 213 Main St.

Denver, Colo.—The Bd. of Pub. Wks. is stated to have adopted specifications for the 13th St. storm sewer; cost estimated at $7,310.

Washington, D. C.—Bids will be received Apr. 15 at the office of Building for National Museum Library of Congress (Bernard R. Green, Supt. of Const.), for concrete pipe trenches, topping out concrete foundations and laying sewers for the new National Museum building this city.

Quitman, Ga.—The citizens are reported to have voted to issue $50,000 to be used for installing a sewerage system and pave the streets in the business portion of the town.

Beardstown, Ill.—The question of constructing a sewerage system is reported under consideration here.

Moline, Ill.—The Bd. of Local Improv. is reported to have under consideration the construction of a sewerage system in the 5th Ward; probable cost of work, $45,000.

Winchester, Ind.—It is reported that bids will be received Apr. 19 by C. C. Yunker, City Engr., for constructing a sewer.

Franklin, Ind.—Otis B. Sellers, City Engr., writes that it is proposed to construct a sewerage system at a cost of $50,000. Time for receiving bids not yet decided upon.

South Bend, Ind.—Bids are wanted Apr. 11 for about 14,000 ft. of pipe seweres. A. J. Hammond, City Engr.

Evansville, Ind.—County Surveyor W. H. Temme and City Surveyor Aug. H. Pfafflin, both of whom will be members of the comsion which will superintend the building of the Kentucky Ave. sewer, are stated to have decided on the route for the greater part of the sewer. The sewer will cost from $250,000 to $300,000, and will be paid for by the city and county and the property owners along the route.

Muskogee, Ind. Ter.—Local press reports state that bids will be received until Apr. 24 by the City Council for constructing storm sewers in 9th and Main Sts., estimated to cost $19.000. S. A. Cobb, City Engr.

Sioux City, Ia.—Bids will be received Apr. 11 by the Com. on Sewers (T. W. Bayne, chmn.), for constructing sewers in portions of W. 4th, Isabella and Ross Sts., consisting of 400 ft. of 18-in., 1,200 ft. of 15-in., and 400 ft. of 12-in. vitrified sewer pipe taken up and relaid; 5 manholes and 11 catch basins.

Abbeville, La.—See "Power Plants, Gas and Electricity."

Perry, Ia.—Engineer M. E. Earl, of Chicago, Ill., is reported to have estimated the cost of sewers for Perry at $61,380. B. C. Dilenbeck, Chmn. Sewer Com.

Caribou, Me.—E. E. Haynes, Gen. Mgr., Caribou Sewer Co., writes that it is proposed to construct a sewerage system by days' work. No bids will be called for.

Salem, Mass.—Bids will be received by the Sewerage Comn., on Apr. 20 (readvertisement) for the construction of a c. i. force main, as advertised in The Engineering Record. The c. i. pipe will be furnished by the city.

Lawrence, Mass.—The Bd. of Aldermen is stated to have passed an ordinance providing for an appropriation of $25,000 to complete the Shanty Pond sewer.

Northampton, Mass.—The Sewer Comrs. are stated to have petitioned the City Finance Com. for an appropriation of $100,000 for an extension of the main sewer to Connecticut River.

**Items marked thus give the names of parties awarded contracts.*

for improving 9th St., requiring 4,300 sq. yds. paving, 1,600 cu. yds. grading, 2,100 lin. ft. curbing, etc. Bids will also be received for improving 14th St., requiring 3,200 sq. yds. paving, 2,500 lin. ft. curbing, sewers, etc. Harry Leith, City Engr.

Xenia, O.—J. E. Jones, Clk. Bd. Pub. Service, writes that it is proposed to pave Market St. with brick, asphalt or bitulithic pavement, at a cost of $38,129. G. A. McKay, City Engr.

Cincinnati, O.—Bids will be received Apr. 26 by the Bd. of Public Service (Geo. F. Holmes, Clk.) for furnishing material and improving a portion of Smith St., by grading, setting granite curbs and crossing, and paving with granite blocks.

Columbus, O.—Bids will be received Apr. 12 by the Bd. of Pub. Service (Chas. H. Frank, Secy.) for constructing a macadam road in Perry Township between the Olentangy and Scioto River Road and the north line of the premises occupied by the Columbus Fishing Club. Engineer's estimate: 32,000 cu. yds, earth excav.; 2,350 cu. yds. rock excav.; 4,290 cu. yds. macadam; 24,000 lbs. c. i. pipe, etc.

Bowling Green, O.—Bids will be received Apr. 24 by R. C. Harding, Co. Aud., for grading, draining and macadamizing B. F. Waggoner Road in Milton Township, and Jerry City Road in Bloom Township. E. L. Spafford, Co. Surv.

Reading, Pa.—It is stated that bids will be received about Apr. 16 by the Bd. Pub. Wks. for paving with vitrified brick on Washington and S. 9th Sts. Chas. G. Weltmer, City Clk.

Braddock, Pa.—Bids will be received Apr. 10, by L. L. Todd, Sec'y, Boro Council, for $132,000 funding and street improvement bonds.

Pittsburg, Pa.—Bonds amounting to $700,000 are reported sold for road improvements in Allegheny County.

Local press reports state that the Co. Comrs. will receive bids until Apr. 24 for macadamizing the following county roads: Imperial and Clinton Road, 4 miles; Pitcairn Road, 3 miles; Three Degree Road, 3¼ miles; Coraopolis and Carnot Road, 3 miles, and Dinsmore Road, ½ mile.

According to local press reports the Co. Comrs. are soon to ask bids for macadamizing portions of three roads in Scott Township.

Dallas, Tex.—It is stated that Dallas County will expend about $50,000 for bridges and road improvement. B. S. Uhl, Engr. in charge of work; office in court house.

Seattle, Wash.—The lowest bid opened on Mar. 25 for concrete walks on 10th Ave. N. was that of McAdam & Cannon for $9,173.

**Tacoma, Wash.*—Geo. Milton Savage & Co., California Bldg., have secured the contract for paving "J" St. for $47,820.

**Seattle, Wash.*—P. J. McHugh, of Seattle, is stated to have received the contract (bids opened Mar. 18) for grading and constructing concrete sidewalks on Main St., for $82,820.

The contract for paving with asphalt on 8th St. is stated to have been awarded to the Barber Asphalt Paving Co., Seattle, for $6,484.

Prince Albert, N. W. Ter.—See "Water."

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Lineville, Ala.—The Council is reported to have granted John S. Jamison and associates a franchise for water works and electric light plant and telegraph and telephone system.

Sturdevant, Ala.—The Tallapoosa Water Power & Elec. Co. is reported incorporated, with a capital of $100,000 by Fred Ausfeld and Robt. A. Chapman, of Montgomery, and Mrs. Dinnie Parker, of Dadeville, to build a dam on Tallapoosa River at Sturdevant for the purpose of generating electricity by water power. Principal office to be at Montgomery.

Washington, D. C.—Bids will be received Apr. 12 at the Treasury Dept. (H. A. Taylor, Asst. Sec'y), for manufacturing and placing in position combination gas and electric fixtures in the following buildings: U. S. Post-Office, at Batesville, Ark.; Traverse City, Mich.; Torrington, Conn.; and U. S. Custom House, Hartford, Conn.

Bids will be received Apr. 18, at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yards, Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., the following supplies: Motors, electrical supplies, conduit, P. & B. electrical compound, incandescent lamps, water pipe system, pipe fittings, valves, iron pipe, Buckeye heater, steel bars and angles, plain and galvanized sheet steel, tool steel, fire brick, wire rope, brass rods, etc. H. T. B. Harris, Paymaster-General, U. S. N.

Bids will be received May 3 by Col. Chas. S. Bromwell at the office of Public Bldgs. and Grounds for lighting portions of public grounds in this city during the year ending June 30, 1906, with high candle power gas lights.

Monroe, Ga.—J. B. McCrary, of Senoia, has been selected to prepare plans for an electric light plant. An election to vote on issuing bonds to the amount of $15,000 for same will be held on April 20.

Shoshone, Idaho.—The Shoshone Power Company is reported incorporated with a capital of $5,000,000, to build a plant on Shoshone Falls. Incorporators: Francis M. Lyman, J. A. Bagley, L. R. Martineau and others.

Indianapolis, Ind.—The following are the bids opened on Apr. 4 by the Superv. Archt., Treas. Dept., Washington, D. C., for furnishing and installing electric light and gas fixtures in U. S. Post-Office and Court House at Indianapolis: Cassidy & Son, New York, N. Y., $16,500. Mitchell-Vance Co., New York, N. Y., $17,020. Horn & Brannon, Philadelphia, Pa., $12,450, and R. Williamson & Co., Chicago, Ill. (partial), $4,800.

Eagle Grove, Ia.—The Citizens' Light, Heat & Power Co. is stated to have secured a franchise for a gas plant.

Centerville, Ia.—J. K. Huston, editor Centerville *Citizen*, writes that the citizens voted March 27 to grant two electric light franchises, one to the Home Electric Co., and the other to the Mutual Electric Co.

Wichita, Kan.—The Wichita Gas, Electric Light & Power Co. is reported to have under consideration the construction of a new gas plant and the laying of new mains.

Lindsborg, Kan.—A. A. Abercrombie, City Clk., writes that bids will be received on Opr. 20 for the construction of an electric light plant to cost $29,000. Engineer Geo. C. Morgan, Chicago, Ill.

Lyons, Kan.—The Lyons Electric & Mfg. Co. will receive bids about May 10 for machihery for an electric light plant which will cost from $8000 to $10,000. Have engaged superintendent and will construct plant by its own labor.

Abbeville, La.—R. C. Huston, engineer, Laurel, Miss., writes that the citizens of Abbeville, on March 28, voted to issue $45,000 bonds for water works, a sewerage system and electric light plant.

Ft. Warren, Mass.—Bids will be received Apr. 12 by Maj. John E. Baxter, Q. M., U. S. A., Room 410, 170 Summer St., Boston, for furnishing and installing electric fixtures and wattmeters in certain buildings here.

Detroit, Mich.—The House is reported to have passed a bill granting permission to the city to issue $150,000 bonds for lighting improvements.

**Menominee, Mich.*—Contracts for constructing a gas plant for the Menominee & Marinette Light & Traction Company are stated to have been awarded as follows: Gas holder, to F. G. Fernstrom, of Menominee; gas machinery and apparatus, the Gas Machinery Company, of Cleveland, O.; and the benches and retorts, Parker-Russell Company, of St. Louis. Total cost about $50,000.

Minneapolis, Minn.—Press reports state that the Minneapolis General Electric Co. (M. B. Koon, Pres., Minneapolis) is about to let contracts for work in connection with utilizing the water power of St. Croix River, at St. Croix Falls, between the villages of St. Croix Falls and Taylor's Falls, Minn.

Duluth, Minn.—Bids will be received Apr. 10 by the Common Council for $240,000 bonds; $140,000 for water and light, and $100,000 bridge bonds. H. W. Cheadle, City Clerk.

Liberty, Miss.—The Board of Aldermen is stated to have granted W. M. White a franchise for water works and an electric light plant.

New Franklin, Mo.—J. M. Settle, Mayor, writes that the citizens on March 27 voted to grant T. H. Todd and Wallace Estill a franchise for an electric light plant.

Troy, Mo.—The City Council is reported to have purchased a site to be used for the municipal electric light plant.

Dodge, Neb.—The Village Clerk writes that it is proposed to construct water works and an electric light plant at a cost of $10,000. Bonds will be issued in about 2 weeks. No engineer selected as yet.

Highlands, N. J.—The citizens are reported to have voted Mar. 30 to issue $25,000 bonds for water works and an electric light plant.

Atlantic City, N. J.—The Atlantic City Suburban Electric Co. is reported incorporated with a capital of $100,000 to furnish heat, light and power. It will petition for a franchise in Pleasantville. Incorporators: Louis E. Kuehale, Harry E. Woodman and John C. Reed.

**Brooklyn, N. Y.*—The following are the bids opened on Apr. 3 by C. B. Snyder, Supt. School Blds., N. Y. City, for electrical equipment for school No. 85, Brooklyn Boro: Commercial Constr. Co., 1 Madison Ave., N. Y. City, $12,738 (awarded contract); Reis & O'Donovan, $15,960, and T. Fred Jackson, $15,000.

Ft. Ontario, N. Y.—Bids will be received by Capt. W. M. Coulling, Q. M., U. S. A., Oswego, on May 2, for furnishing all labor and material necessary for installing interior and exterior lighting at Ft. Ontario as advertised in The Engineering Record.

Albion, N. Y.—The Bd. of City Trustees is reoprted to have granted the Niagara Falls Power Co. franchise to construct a transmission line to Albion. Dr. Coleman Sellers, Ch. Engr., Niagara Falls.

Monroe, N. Y.—Z. Paddleford and Luther Terwilliger are reported to be incorporators of a company organized to supply electricity in Monroe, Chester, Turner, Central Valley, Highland Mills and Hillburn.

**Lockport, N. Y.*—The Iroquois Construction Co. is reported to have sublet to the Archbold-Brady Co., of Syracuse, the contract to build transmission lines for the Niagara, Lockport & Ontario Power Co. from Niagara Falls to Lockport and Rochester and from Lockport to Buffalo.

Pendleton, N. Y.—The Town Council is reported to have granted the Niagara, Lockport & Ontario Power Co. a franchise to construct a power canal and transmission line through the town.

Potsdam N. Y.—The citizens are reported to have voted March 22 to issue $40,000 bonds to install a municipal electric light plant.

Dayton, O.—The Dayton Elec. Light Co. (Dr. J. E. Lowes, Pres.), and the Montgomery Co. Elec. Light Co. are stated to have been consolidated as the Dayton Lighting Co. The new company will have a capital of $2,500,000; $1,000,000 will be spent in equipment, and it is reported that $600,000 worth of machinery has already been ordered.

Springfield, O.—The Springfield Gas and Electric Co. will expend about $30,000 for new gas receiver and a storage tank with a capacity of 250,000 cu. ft.

Madison, O.—The question of establishing an electric light plant is reported under consideration here.

Belpre, O.—There is reported to be a movement here looking to the construction of water works and an electric light plant.

Oregon City, Ore.—The Portland General Electric Co., (H. W. Goode, mgr., Portland) is reported to have petitioned the County Commissioners for a franchise over the County roads between Oregon City and Aurora. It will also petition for a franchise in Marion County for a transmission line between Aurora and Salem.

Pittsburg, Pa.—Press reports state that plans are being prepared by the architects of the new Carnegie Technical School for a temporary power house to be located at the top of the hollow.

**Philadelphia, Pa.*—Horn & Brannen, 427 N. Broad Street, are stated to have secured the contract for electric light and gas fixtures for the Northeast Manual Training School for $9950.

Providence, R. I.—It is reported that the Narragansett Electric Company (Fred N. Bushnell, chief engineer, Providence), will expend about $200,000 on underground construction and rewiring of houses on the East Side.

Sioux Falls, S. D.—See "Electric Railways."

Athens, Tenn.—It is reported that the Athens Light & Power Co. proposes purchasing additional equipment.

Lawrenceburg, Tenn.—F. M. Lincoln is reported interested in the construction of an electric light plant.

Shelbyville, Tenn.—There is reported to be a movement here looking to the town purchasing the present water works and electric light plant or constructing new plants.

Dickson, Tenn.—The citizens are reported to have voted to issue $6,000 bonds for an electric light plant.

**McKinney, Tex.*—The Hunter Electric Light Supply Co., of Dallas, is reported to have received the contract for a municipal electric light plant for $6,500.

Cape Charles, Va.—I. J. Burbage, Town Clk., writes that no bids were received on April 3 for the electric light franchise, and the time for receiving bids was extended for 60 days.

Fredericksburg, Va.—Water and gas bonds to the amount of $20,000 are reported sold.

Spokane, Wash.—I. Dornberg, treasurer Black Carbon Coal Co., is reported to have petitioned Council for franchise for a steam-heating plant.

Sumas, Wash.—R. S. Fisher, of Seattle, is stated to have petitioned Council for a franchise for water works and an electric light plant.

Berkeley Springs, W. Va.—A charter has been granted to the Berkeley Springs Light & Water Co., with capital of $25,000. Incorporators: Henry N. Hanna and Eugene L. Norton, of Baltimore, Md.; J. Frank Field, Hancock, Md.; H. T. B. Dawson, of Berkeley Springs, and others. The company proposes to construct a reservoir to supply water to Hancock, which is a distance of six miles.

Milwaukee, Wis.—Jacob Cloos, Consulting Engr., Matthews Bldg., writes that the date of opening of bids for the construction of a light and power plant on the North Side for the Wisconsin Light & Power Co. has been extended to Apr. 11, at 10 A. M., with the exception of the concrete work the contract for which was awarded to W. F. Noble, of La Crosse. J. G. Schweizer, Sec'y, La Crosse.

Mexico City, Mex.—Local press reports that the Mexican Light & Power Co. (Francisco Neugebauart, mgr., Mexico City), contemplates expending about $50,000 in improvements to its Necaxa power plant.

Samson Lang is reported to have obtained a concession from the Government, signed on Mar. 11, authorizing him to utilize water from Amacuzac River, in the district of Jojutla, State of Morelos. The quantity granted is up to 78,000 liters per second, to be used for motive power, and the plant will be established near the town of Xicotlacotla, at the confluence of the Amacuzac and the Higueron Rivers.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

South Norwalk, Conn.—Wm. Wardwell, of New Canaan; Eben Hill, of Norwalk, and others, are reported interested in a plan to build an electric railway from Norwalk to Ridgefield and New Canaan.

Bloomington, Ill.—It is stated that the Springfield & Northeastern R. R. Co. will build 60 miles of line between Springfield, Lincoln and Bloomington. Lafayette Funk, of Bloomington, Pres.; Frank W. Aldrick, of Bloomington, Sec. and Treas.; C. E. Collins, of Chicago, Ch. Engr.

The construction of an electric railway between Bloomington and Decatur, a distance of 44 miles, is reported in contemplation by the Bloomington, Clinton & Decatur Interurban Traction Co., recently incorporated at Springfield, with a capital of $250,000. H. W. Knight, of Kansas City; Jerome J. Danforth, of Chicago, and others are reported interested.

Hoopeston, Ill.—Articles of incorporation have been filed by the Interstate Traction Co., of Hoopeston, with a capital of $100,000, to construct a line from a point in Edgar County, Ill., on the State line between Indiana and Illinois, to
Chicago, Ill., and from a point in Ross T
Ill., to Potomac; Paxton to Bloomingt
from a point in Grant Township, Ill., eas
State line between the States of India
Illinois. Incorporators: Jas. H. Dyer,
Cunningham, Alfred H. Trego and oth
of Hoopeston, Ill.

Indianapolis, Ind.—The Indiana, I
City & Eastern Traction Co. is reporte
porated with a capital of $25,000. The c
which has its headquarters at Alexandr
reorganization of the Indianapolis, I
City & Celina Traction Co., incorpora
year. The company will build a line f
dianapolis to Celina, O. C. G. Buell,
Weedon, R. G. Kirkpatrick and others
rectors.

Mt. Ayr, Ia.—The citizens of Mt.
stated to have voted a subsidy to aid t
struction of the St. Joseph, Albany
Moines Electric Ry.

Belle Plaine, Ia.—The construction o
urban railway from Grinnell to Belle I
reported contemplated. The line to b
25 miles long. Mr. Cole, Pres. Grinnel
urban Ry. Co., is reported interested.

St. Louis, Mo.—The East St. Louis &
ban R. R. and the East St. Louis Electri
Co. will, it is reported, change the gage
roads from the present width of 4 ft. 1
the standard gage of 4 ft. 8½ in. at a
from $85,000 to $100,000. It is also un
that it is a move toward connecting th
urban lines between Chicago and East. St

New York, N. Y.—The New York Cit
borough Co. is stated to have received
proval of the State Bd. of Railroad Co
increase its capital from $400,000 to $1
and to issue a mortgage for $7,000,000. T
pany was also granted authority to use t
head electric trolley and operate lines t
out Bronx Boro.

Schenectady, N. Y.—It is stated that th
nectady Ry. Co. now controlled by the Ne
Central R. R. will construct an interurb
from Rexford's Flats to a point near L
Corners, crossing the river at Dunsbachs
where it will connect with the Cohoes ex

Freeport, N. Y.—The Long Beach Tra
tion Co. is stated to have purchased a
right of way for an electric railway from
Ave., Freeoprt, through to Little Swift
at the foot of Woodcleft Canal.

Glen Cove, N. Y.—The Glen Cove
Ry. Co. is stated to have received a f
to construct a line in Glen Cove, incluc
spur to Garvie's Point, which will conne
the village. J. B. C. Tappan is reporte
ested.

Niagara Falls, N. Y.—The Electric Ry.
Niagara Falls is stated to have received
chise to construct an electric railway in
Falls. S. P. Franchot, Pres.

Bellefontaine, O.—It is stated that
bana, Bellefontaine & Northern Traction
build a spur line and loop at Chautauqu
near Bellefontaine.

Coshocton, O.—Dr. John Shrontz a
Baird, of Martinsburg, are reported to
sidering the construction of an electric
from Coshocton to Mt. Vernon by way
Walholding Valley.

Dayton, O.—It is reported that the
& Xenia Traction Co. is planning to buil
off from a point on its line near Alp
point on the Springfield & Xenia Tractio
pany's line.

Bloomdale, O.—The Fostoria, Bloom
North Baltimore Traction Co. is reported
applied for a franchise in Bloomdale. T
pany proposes to build from Fostoria to
S. P. Douglass, of Toledo, Pres.

Zanesville, O.—The Zanesville Ry., I
Power Co. is stated to have applied for
chise to build a new line on Marietta
Linden Ave.

Springfield, O.—It is stated that N. M
mell, of Catawba, O., is interested in t
motion of an electric line to extend from
field to Delaware by way of New M
Catawba, Mechanicsburg, Milford and
ville.

Carrollton, O.—The Canton & Steu
Electric Ry. Co., contemplates construct
spring a line to connect Canton, Carrollt
lem Springs, Amsterdam, Richmond an
benville, with a spur line to Cadiz.
Loomis, Ch. Engr.

Oberlin, O.—It is stated that the Ob
Lorain Ry. Co. is securing right of w
a line from Oberlin to Lorain by way o
Amherst.

Caledonia, O.—T. A. Gruber, of Caledi
stated to have under consideration the c
tion of a line from Galion to Marion
of Caledonia, Iberia and Martel.

Lancaster, Pa.—It is stated that th
caster, Oxford & Southern Ry. Co. conte
construction of an extension from Fa
to Quarryville. It is reported that the c
will be reorganized and the line will be co
into an electric railway.

Greensburg, Pa.—The Westmoreland
is reported to have under consideration
struction of an extension from Lat
Greensburg and the building of spurs
portant mining towns in the eastern end
county.

Providence, R. I.—It is stated that th
Judith R. R. Co. contemplates construc
electric railway from Narragansett Pier
Judith.

Sioux Falls, S. D.—The City Ry. Co
ported incorporated with a capital of $50
construct a city and suburban electric
and to sell electric power for manufactur
poses. The proposed line is to be 20

**Items marked thus give the names of parties awarded contracts.*

h, and to operate out of Sioux Falls into counties of Minnehaha, McCook, Turner, and Moody, in South Dakota, and the ies of Rock, in Minnesota, and Lyon, in Incorporators are: J. R. Sheeley, of Os- Ia.; G. W. Rhine and Tore Tiegen, of Falls, S. D.

rfolk, Va.—The Seaboard Traction Co. is to have applied to the Council of Ports- for rights of way for an electric railway will run from Smithfield to Portsmouth Suffolk, and thence on through Petersburg anchester. L. R. Britt, of Norfolk, pres.

kane, Wash.—J. P. Graves, of Spokane, warded Porter Brothers, of Duluth, Minn., al contractors, the contract for grading ne in which he is interested, to run out of ine.

mpia, Wash.—The City Council is stated ve passed the ordinance granting a fran- to the Pacific Traction Co., the company is building the electric interurban railway en Olympia and Tacoma.

ntington, W. Va.—It is stated that the Cam- nter-State Ry. Co. is planning to extend its north from Hanging Rock, O., to connect the line of the Portsmouth Street Railway.

lwaukee, Wis.—It is stated that the Milwau- lectric Ry. & Light Co. will construct a line Waukesha Beach to Oconomowoc. It will miles long and cost $300,000.

atham, Ont.—The Wallaceburg & Lake Erie Co. contemplates constructing an electric ay between Chatham and Wallaceburg. The house will probably be located at Chat-

RAILROADS.

otes Arranged Alphabetically by States.

na, Ark.—J. G. Johns, of Mena, one of ncorporators of the Keystone Slate Co., like to correspond with some active rail- promoter who would construct a railroad o the mines.

ttville, Cal.—The Butte County R. R. Co. M. Clough, Gen. Mgr., Chico, Cal.), is to have decided to extend its line from ng City to Prattville along the north fork eather River—a distance of 50 miles.

men, Ga.—The Bremen & Southwestern is reported to have been organized at rdsville, Ala., to build a railroad 25 long from Bremen, Ga., to Wedowee, Ala., ng the Central of Georgia and the South- t Bremen, and running into that part of olph County in Alabama; capital, $50,000. porators: H. N. Gardner, L. B. Parker A. A. Hurst.

arwater, Idaho.—The Northern Pacific R. o. (E. J. Pearson, Ch. Eng., St. Paul,) is reported to be making preparations for onstruction of a line in the Clearwater in Idaho. Surveying parties are now ed in resurveying some of the lines. Oregon R. R. & Navigation Co. (J. P. en, Gen. Supt., Portland, Ore.), is also ed to be making surveys in Clearwater

ianapolis, Ind.—The Pan Handle R. R. W. Mansfield, Div. Supt., Indianapolis), is ed to have decided to construct 9 miles lditional side track on the Indianapolis on; also install an interlocking plant at rd Central; total cost of improvements nplated by the company reported to be 000.

body, Kan.—Press reports state that two acts are about to be let by the Sante Fe (Jas. Dun, Ch. Eng., Chicago, Ill.), for ad construction between Peabody and Leh- and between Melvern and Olivet. They require changes of line to straighten out curves; the former will require a large nt of excavation.

ntracts for other portions of work on this are stated to have been awarded as fol- To Haines & Co., of Shorey, Kan., for between Kernan and Streator, Ill. Likes tfield, of Wichita, between Florence and dy, Kan. Pettibone, Sentry & Co., of go, between Bucklin and Marceline, Mo. ron, McManus & Joyce, of Keokuk, Ia., en Streator and Macuta, Ia., and Hardin Lexington, Mo. The Lantry-Sharp Contr. between Macuta and Nixon, Ia., Zarah Olathe, Kan., H. U. Tower and Melvern, and Olivet and Lebo, Kan.

isville, Ky.—W. H. Bruce, Asst. Sec'y ville & Nashville Ry. Co., writes that the holders at a meeting Mar. 28 voted to $50,000,000 bonds. According to press s much of the money will be used for ad construction. A part will be used for onstruction of terminals at Atlanta, Knox- Cincinnati and other points. The line Knoxville to Atlanta, though now being ted, will be practically rebuilt, so that of the curves will be cut out and the greatly improved.

xandria, La.—It is reported that the Alex- a, Bayou Macon & Greenville Ry. Co. pro- to complete the surveys from Eudora, to the Mississippi River, opposite Green- Miss., and from Wisner, La., to Alex- a, La., after which construction will prob- begin.

nmesport, La.—It is reported that en- rs, representing the Texas & Pacific R. R. B. B. Wathen. Ch. Engr., Dallas, Tex.), t Simmesport, running the survey for the sion of the Avoyelles Division Road to lle. The length of the proposed line is 30 miles.

ew Orleans, La.—The Oliver Constr. Co., noxville, Tenn., is stated to have secured ontract for constructing 65 miles of new ad for the New Orleans & Great Northern from Slidell, La., to China Grove.

bbing, Minn.—It is reported that the U. S. Corporation will extend its Duluth, Missabe & Northern road from Hibbing to the Mississippi River, a distance of about thirty miles.

Jackson, Miss.—The Mobile & Ohio R. R. Co. is reported to be considering the feasibility of extending the proposed Shuqualak-Edinburgh branch to Jackson. A. J. Alexander, Div. Supt., Meridian, Miss.

Cleveland, O.—The Baltimore & Ohio R. R. Co. (D. D. Carothers, Ch. Engr., Baltimore, Md.), is reported to have under consideration improvements at Cleveland to cost about $1,000,000, to include new track work and two new unloading devices.

**New Castle, Pa.*—A contract is stated to have been awarded by the Bessemer & Lake Erie R. R. Co. to the Chas. A. Sims Constr. Co., of Philadelphia, for the construction of 18 miles of new railroad from Gibson Junction to New Castle, for about $300,000.

**Butler, Pa.*—S. A. Maselli & Co., of Pittsburg, are stated to have secured the first construction contract in the building of the Western Allegheny R. R., from Butler to New Castle. The contract calls for 15 miles of the heaviest work on the entire line. It is reported that the cost of building the road will be about $600,000.

Corry, Pa.—Bids are wanted for building the C. F. & N. E. Ry., to include 462,937 cu. yds. of earth cut and 431,372 yds. earth fill. Supplies, including 48 miles of wire fence and 31 miles of telephone, block system, etc., are wanted. Address C. H. Dodge, St. James Hotel, Corry.

Pierre, S. D.—The Chicago, Wisconsin & South Dakota R. R. Co., of Pierre, is reported incorporated, with a capital of $1,000,000, to construct a road from Viroqua, Wis., to Pierre, S. D., 767 miles in length. Incorporators: A. S. Hendricks and Chas. S. Hendricks, of Chicago, Ill., and F. A. Stephens, of Pierre.

Paris, Tex.—The Arkansas Central R. R. Co. (J. H. Wright, Pres., Ft. Smith, Ark.), is reported to be preparing to extend its line from Paris to Dardanelle, a distance of about 60 miles.

Port Townsend, Wash.—It is reported that within the next few months $60,000 will be expended upon the road bed of the Port Townsend Southern R. R. (E. J. Pearson, Ch. Engr., St. Paul, Minn.), between this city and Quilcene, a distance of 28 miles.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Prattville, Ala.—It is reported that bids will be received Apr. 17 by the Bd. of Revenue for erecting a county jail, to cost about $12,000 and a court house to cost about $40,000.

Wynne, Ark.—John Graham, Chmn. Co. Comrs., writes that bids will be received Apr. 28 for the erection of a court house for Cross County; probable cost, $40,000. Archts. Brun Architectural Co.

Los Angeles, Cal.—It is reported that Gov. La Grange, of the Soldiers' Home, has received notice that the following appropriations have been approved by Congress and are now available: $34,000 for an additional barracks; $7,200 for a storage reservoir and $7,100 for a fire pump and an ice-making machine. It is stated that bids on the work will be asked as soon as specifications have been made.

Long Beach, Cal.—The citizens are reported to have voted to issue $30,000 bonds for the erection of a convention hall. Architect, J. C. Neuson, of Los Angeles.

Sacramento, Cal.—It is reported that the Governor has signed the bill appropriating $352,000 for improvements to the capitol.

**Marysville, Cal.*—R. Dewar, of San Francisco, it is reported, has received the contract to erect the John Q. Packard Library at $66,300.

Hartford, Conn.—Henry F. Smith, City Clk., writes that the citizens voted on Apr. 3 to issue $24,000 bonds for improving police station. For further information address Police Comrs.

Washington, D. C.—Sec'y Taft, it is stated, has approved the recommendation of Surgeon-Gen. O'Reilly for the erection of the new general army hospital on the Cameron tract on Brightwood Ave. Congress has fixed the cost of the hospital, including site, at $300,000.

A site has been selected on the grounds of the Washington Asylum for a workhouse for males to be erected at a cost of about $60,000. It is reported that bids for its construction will be asked in about a week.

Macon, Ga.—The following are the bids opened on Apr. 3 by the Superv. Archt., Treas. Dept., Washington, D. C., for enlarging the U. S. Court House and Post-Office at Macon, not including elevator, heating apparatus, conduits and wiring: Mankin Constr. Co., Richmond, Va., $215,000; Thos. Reilly, Philadelphia, Pa., $236,000; W. H. Baily, Henderson, Ky., $242,181; Miles & Bradt, Atlanta, Ga., $246,606; Savannah Constr. Co., Savannah, $22,000; Fissel & Wagner, New York, N. Y., $227,100; W. J. Beeland, Macon, $268,673; Cramp & Co., Philadelphia, Pa., $226,100; Geo. Moore & Son, Nashville, Tenn., $228,800, and Moise De Leon, Atlanta, $243,000.

Boise, Idaho.—The State Prison Bd., it is stated, has decided upon improvements to be made to the prison which will add 144 cells and cost about $54,000.

Jacksonville, Ill.—Bids will be received by the Superv. Archt. Treas. Dept., Washington, D. C., on May 1 for constructing complete U. S. Post Office at Jacksonville, as advertised in The Engineering Record.

Indianapolis, Ind.—The resident companies of the Indiana National Guard are said to be contemplating the erection of an armory at a cost of $30,000.

**Hammond, Ind.*—Winchester & Cullen, of Janesville, have secured the contract for erecting the U. S. Post Office and Court House at Hammond (bids opened Mar. 13) for $102,644.

Fowler, Ind.—The Federation Woman's Club, it is reported, is about to ask bids for erecting a library to cost about $10,000.

Richmond, Ind.—J. W. McCardle, of Richmood, writes that no architect has as yet been selected to prepare plans for the Southeastern Indiana Hospital for Insane. According to reports it will be erected at Columbus or Seymour, and cost about $560,000.

Waterloo, Ia.—The following are the 3 lowest bids opened on Mar. 30 by the Superv. Archt. Treas. Dept., Washington, D. C., for a heating apparatus for U. S. Post Office at Waterloo: J. A. Bean & Co., Macomb, Ill., $3,173; Simms-Powers Co., Sioux Falls, S. D., $3,282, and Zook & Bentley, Waterloo, $3,464.

St. Joseph, La.—It is reported bids are wanted Apr. 24 for erecting a court house and jail. F. H. Curry, Pres., Police Jury.

**Baltimore, Md.*—The Bd. of Awards, it is stated, has awarded the contract for erecting the superstructure of the Fish Market, at Centre Market site, to Cramp & Co., of Philadelphia, Pa., at $103,376, and the contract for the foundation work to the Cranford Paving Co., of Brooklyn, N. Y., for concrete caissons at $9,700.

Worcester, Mass.—The erection of a police station at a cost of $90,000 is reported under consideration.

The joint standing Com. of the City Council, it is stated, has decided to recommend the erection of a new police headquarters building on Waldo St., to cost $90,000.

**Attleboro, Mass.*—C. S. Holden, Sec'y Bldg. Com., writes that the contract for erecting a library (bids opened Mar. 27) has been awarded to Grant Bros., of Attleboro. Cost reported to be about $50,000. Architects, McLean & Wright, 110 Tremont St., Boston.

Boston, Mass.—Bids will be received by Mordecai T. Endicott, Chief Bureau of Yards and Docks, Washington, D. C., Apr. 29, for fireproof floors and stairways for Bldg. No. 42, at Navy Yard, Boston. Plans will be furnished by the Bureau on a deposit of $10.

Ft. Strong, Mass.—Bids are wanted Apr. 20 for furnishing material and remodeling brick guardhouse; also for plumbing, steam heating and electric wiring here. Maj. John E. Baxter, Q. M., U. S. A., Room 410, 170 Sumner St., Boston.

Flint, Mich.—Bids will be received Apr. 27 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for the construction (except heating apparatus) of the U. S. Post Office here.

**Grand Haven, Mich.*—The Klie Htg. & Plumbing Co., of Columbus, O., has secured the contract for installing a plumbing system in the U. S. Post-Office (bids opened Mar. 22), for $1,774.

St. Paul, Minn.—A pavilion is to be erected in Como Park at a cost of $40,000.

Jefferson City, Mo.—Plans will be received until May 1 by the Bd. of Comrs. of the new Supreme Court Bldg. (Herbert S. Hadley, Sec'y), for said building, as advertised in The Engineering Record. Approximate cost, $180,000.

**Moberly, Mo.*—J. A. Daly, of Nevada, has secured the contract for erecting the U. S. Post Office at Moberly, including plumbing, heating apparatus, electric wiring and conduits, for $28,837.

St. Joseph, Mo.—F. J. Mass, Chmn. Bldg. Com., writes that proposed auditorium, bids for which will be opened on April 18, will cost $150,000. Archts. Eckle & Mann, Commercial Bldg.

St. Louis, Mo.—Bids will be received May 2 by the Pres. Bd. Pub. Improv., for erecting a fire-proof Pathological Building at the new City Hospital. Estimated cost, $35,000.

Omaha, Neb.—The Methodist Assoc., it is reported, will erect a $50,000 hospital. Clayton W. De Samatre, Pres.

Jersey City, N. J.—The Bd. of Health has approved plans prepared by Clinton & Russell, 32 Nassau St., N. Y. City, for the new City Hospital, and it is reported that as soon as specifications have been prepared bids for the construction of the building will be asked. Appropriation, $200,000.

New York, N. Y.—The Bd. of Aldermen has authorized an appropriation of about $1,000,000 for the Dept. of Health. Com. Darlington, it is stated, has announced that the greater part of the money would be used for new hospital sites, enlarging the plants of hospitals and of the Kingston Ave. Hospital, in Kings.

Ordinances were also adopted by the Bd. of Aldermen appropriating $200,000 for sites and buildings for the Fire Dept. in Richmond and Queens Boroughs; $256,000 for fireboats and $300,000 for parks, parkways, etc., in Brooklyn and Queens Boroughs.

Brooklyn, N. Y.—The following are the bids opened Apr. 4 by John McG. Woodbury, Com. St. Cleaning, for a stable on Flushing Ave. and Graham St.:

General construction: Fuller & O'Connor, $321,490; Ryan & McFerran, $321,700; Murphy Bros., $337,464; T. W. Carlin Constr. Co., 26 Court St., $307,000; D. J. Ryan, 723 3d Ave., $319,000; Kelly & Kelley, $326,557, and R. E. Heningham, 4 Court St., $319,750.

Ventilating and heating: Donegan & Swift, 6 Murray St., N. Y. City, $6,650; Dowdswell Bros., 399 Bridge St., $6,864; Baker, Smith & Co., W. B'way & Houston St., N. Y. City, $5,498.

Plumbing: C. Nally, N. Y. City, $14,642; Jas. Harley, 288 Flatbush Ave., $13,313; Rossman & Bracken Co., 132 E. 42d St., N. Y. City, $13,954.

Electric work: Jos. M. Roman, $2,240; Brown & McClure, 150 5th Ave., N. Y. City, $2,091; Thompson Barney Co., 45 Court St., $2,091; T. F. Jackson, 592 Columbus Ave., N. Y. City, $2,061; Geo. Wiederman, $2,100; M. B. Foster Co., $2,113; Reis & O'Donavan, $2,300.

New Brighton, S. I., N. Y.—Bids will be received Apr. 18 by Geo. Cromwell, Pres. Boro. Richmond, for furnishing all labor and material required for general interior work in the Richmond Boro Hall.

Elmira, N. Y.—It is reported that fire has destroyed several buildings at the Elmira Reformatory, including the tailor shop, storehouse, laundry, shoe shop, blacksmith shop and broom shop. It is reported that the Legislature will be asked to make a special appropriation to repair the damages.

Ft. Slocum, N. Y.—Bids will be recived until Apr. 19 for steam heating and electric wiring brick double barrack. Address W. J. Davis, Q. M.

Ogdensburg, N. Y.—Supt. Hutchins, it is reported, has recommended the erection of an addition to the St. Lawrence State Hospital to cost $12,000.

Poughkeepsie, N. Y.—Bids will be received by the State Comm. in Lunacy at Albany, on Apr. 12, for constructing a tuberculosis pavilion at the Hudson River State Hospital at Poughkeepsie, as advertised in The Engineering Record.

**Elizabeth City, N. C.*—The General Supply & Constr. Co., of New York, N. Y., has secured the contract for constructing complete U. S. Post-Office at Elizabeth City (bids opened Mar. 20), for $84,920.

Ft. Lincoln, N. D.—Bids are wanted Apr. 12 for constructing several buildings, including brick fire apparatus building, brick shop and addition to coal shed. Address Lieut. R. H. Leavitt, Q. M.

Akron, O.—The preliminary plans submitted by J. Milton Dwyer, of Cleveland, for the court house, have been approved, and the Court House Comn. has authorized working plans to be prepared at once. Probable cost, $275,000.

Mansfield, O.—Vernon Redding, of Mansfield, it is stated, has been engaged to prepare plans for the Andrew Carnegie Library, for which $35,000 has been donated.

Marion, O.—The Bd. of Pub. Safety has approved the plans submitted by Wilbur T. Mills, of Columbus, for an engine house, which it is proposed erecting in the West End. It is to be a 2-story brick structure.

Elyria, O.—Bids will be received May 2 by Frank R. Fauver, City Aud., for $12,000 bonds for improving and remodeling the town hall.

Shawnee, Okla. Ter.—The City Council, it is reported, has approved plans for a $30,000 city hall and a $10,000 jail and fire headquarters building, to replace those now in use.

Norman, Okla. Ter.—It is reported bids are wanted Apr. 20 for erecting a court house and jail; probable cost, $40,000. F. O. Miller, Co. Clk.

Lima, Pa.—It is reported that bids will be received by the Dir. of the Poor of Delaware County, at Media (Frank F. Sharpless, Sec'y), until Apr. 27, for constructing buildings at the County Home here for the care of the County's Insane, buildings and furnishings to cost about $150,000. Plans may be obtained from Harry L. Reinholds, Jr., Archt., of Philadelphia, on a deposit of $100.

Florence, S. C.—Bids will be received May 6 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for furnishing the heating apparatus complete in place, for the U. S. Post Office and Court House here.

Jackson, Tenn.—The erection of a County and City Hospital, to cost about $50,000, is reported under consideration.

Nashville, Tenn.—It is reported that the Little Sisters of the Poor intend erecting a $30,000 building, to be known as the Old Men's and Old Women's Home.

**Edna, Tex.*—The Dawson Constr. Co. (Inc.), of Houston, it is stated, has received the contract to erect the court house for Jackson County at $43,000.

Richmond, Va.—The erection of a cancer hospital to cost about $20,000 is reported under consideration. The Co. Bd. of Health may be able to give further information.

Medical Lake, Wash.—J. K. Dow, of Spokane, has been selected to prepare plans for a building for the Washington Hospital for Insane, to be erected here; appropriation, $55,000.

Wheeling, W. Va.—It is reported that plans have been completed for a 54-room addition to the hospital. Address Rev. E. Weber, 13th and Byron Sts.

Neenah, Wis.—Capt. J. B. Schneller, it is stated, has accepted plans prepared by H. A. Foeller, of Green Bay, for an armory to be erected for Company I on the island at a cost of $15,000.

**Baraboo, Wis.*—John M. True, Chmn. Bldg. Com., Co. Comrs., writes that the following are the 4 lowest bids opened on Mar. 29 for erecting the county court house: J. F. McCarthy, $83,384; Eilenberger & Co., $84,490; W. H. Cook, $85,000 and W. J. Reade, $85,000. According to press reports, J. F. McCarthy, of Madison, secured the contract.

Laramie, Wyo.—Bids will be received May 11 by Jas. Knox Taylor, Superv. Archt., Washington, D. C., for constructing (except heating apparatus) for the U. S. Post Office here.

Ancon, Panama.—The Panama Canal Comn., it is stated, has authorized the constructing of a marine barracks here to cost about $65,000.

Items marked thus give the names of parties awarded contracts.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—A 3-story brick hotel, it is stated, is to be erected at 17th St. and 3d Ave. by R. P. McDavid, at a cost of $25,000.

Mobile, Ala.—It is reported that the Alabama R. R. Comn. has ordered the Southern Ry. (S. Hazard, Roadway Engr., Birmingham, Ala.), to erect a union passenger station here to cost $250,000.

Colton, Cal.—It is reported that Wm. Anderson will erect a $30,000 hotel at 8th and I Sts.

Long Beach, Cal.—C. F. Whittlesley, of Los Angeles, is stated to be preparing plans for a 10-story hotel for Long Beach, to cost $200,000.

Denver, Colo.—Murto & Humphries, it is stated, intends erecting a $25,000 building, at Gaylord St. and 17th Ave.

A building permit has been granted to Edwin Hewitt, the Blake St. candy mfr., for the erection of a 6-story office building to be erected at 15th and Arapahoe Sts., which is to cost $100,000. Gove & Walsh, Archts., 55 McPhee Bldg.

Boulder, Colo.—It is reported that Crane & Co. are contemplating the erection of a $40,000 opera house.

Fernandina, Fla.—Maj. Geo. R. Fairbanks, it is stated, is interested in the company which is about to be incorporated as the Fernandina Hotel Co., for the purpose of erecting a hotel here to cost about $50,000.

Macon, Ga.—W. H. McDoel, of Chicago, Ill., Pres. of the Chicago, Indianapolis & Louisville Ry., it is stated, is interested in the erection of a 10-story steel office building, which it is proposed erecting at Cherry and 2d Sts., at a cost of $100,000.

Waycross, Ga.—The Atlantic Coast Line Co. (E. B. Pleasants, Ch. Engr., Wilmington, N. C.), it is reported, will make improvements here, including the erection of a repair shop to cost $400,000.

Boise, Idaho.—J. Dietrich, of Salt Lake City, Utah, it is reported, has received the contract to erect the Kimberly Hotel for John Crocker, at $75,000.

Moline, Ill.—It is reported that plans have been submitted for an opera house which it is proposed erecting in this city. E. E. Morgan, Skinner Bldg., may be able to give further information.

Indianapolis, Ind.—Plans have been prepared by Foltz & Parker, Union Trust Bldg., for the new County Club bldg., which is estimated to cost $30,000. It is stated that bids are soon to be received. Walter L. Milliken, Pres. Bldg. Com.

Greensburg, Ind.—It is stated that the I. O. O. F. are contemplating the erection of a $30,000 business building and lodge hall this season and will receive bids as soon as plans are approved.

Evansville, Ind.—The Order of Elks, it is stated, has rejected all bids rceived for the erection of their new home in this city, as they exceeded the amount available, which is $40,000. It is reported that new plans are to be prepared by Henry Lord Gay, of Chicago, Ill., and bids again received on the new plans.

Des Moines, Ia.—Plans are now being prepared, according to reports, for a freight depot which the Inter-Urban Ry. Co. (F. S. Cummins, Ch. Engr., 607 Mulberry St.), intends erecting.

It is reported that plans have been decided upon by the Homestead Co. for a 4-story 132x66 ft. building to be erected at 3d and Locust Sts., at a cost of $100,000.

Clinton, Ia.—It is stated that bids will be received until Apr. 15 by John Morrell & Son, 315 Howes Blk., for erecting a Y. M. C. A. Bldg.

Sioux City, Ia.—It is reported that Orcutt Bros. are contemplating the erection of a 4-story hotel at a cost of $25,000.

Rockwell City, Ia.—It is reported that bids are to be received until Apr. 15 for a 2-story block block, 60x100 ft., to be erected for Geo. L. Brower, at a cost of $20,000.

Salina, Kan.—It is reported that the Union Pacific R. R. (J. B. Berry, Ch. Engr., Omaha, Neb.), intends spending $100,000 in terminal facilities in this city this summer. The work includes new yards, freight and passenger depots and a new roundhouse.

Leavenworth, Kan.—The following are reported to be the bids recived Mar. 27 for erecting the Espenscheid Bldg., at 5th and Delaware Sts.: John Wright, $30,591, time 8 months; Robert Yoakum, $29,990, 4 months; Thomas Jones, $32,665, 5 months; Mr. Garthwaite, Chicago, $32,183, finish in 6 months; Mr. Lloyd, St. Louis, $30,599, finish in 4 months; John Barnes, $29,874, 165 working days; Chas. Boyd, $32,833, 7 months; P. McLoughlin, $34,000, 4 months.

Covington, Ky.—A building permit has been granted to Crigler & Crigler, distillers, for a $20,000 store and warehouse which is to be erected at Scott and 5th Sts.

New Orleans, La.—A 3-story brick and marble building is to be erected for the Stock Exchange at a cost of $20,000.

**Baltimore, Md.*—John Hiltz & Son, 3 Clay St., it is reported, have received the contract to erect 2 warehouses at Lombard and Calvert Sts. for the Deford Co. The total cost is reported to be $39,300.

Woodruff-McLaughlin Co., 100 E. Lexington St., it is reported, will prepare plans for a factory which is to be erected at 31 S. Frederick St. for Ammidon & Co. Cost, $25,000.

**Boston, Mass.*—Plans have been filed for a 6-story brick building to be erected on 71-75 Pitts St. for E. B. Badger & Son, 69 Pitts St. Archts., Kendall, Taylor & Stevens, 93 Federal St. Builder, C. A. Dodge & Co., 8 Beacon St.

Worcester, Mass.—E. W. Maynard, 226 Tremont St., Boston, is preparing plans for altering the Crompton Block into a theater, at a cost of $40,000. Owner, S. Z. Poli, of New Haven, Conn.

Webster, Mass.—Racico Bros., will erect a brick business block here to cost $20,000. Archt., W. B. Nourse, of Worcester.

Saginaw, Mich.—The plans of C. L. Cowles, Chase Blk., have been adopted for Saginaw Elks Temple, to cost $40,000.

Winona, Minn.—Plans have been submitted for a 3-story brick and terra cotta Y. M. C. A. building, which it is proposed erecting at 5th and Johnson Sts. R. E. Squires, Gen. Secy.

Minneapolis, Minn.—It is reported that John Clark and Elizabeth Lyman will erect a 5-story brick block at 529 Hennepin Ave., according to plans perepared by Kees & Colburn, 603 Kasota Blk. Total cost, $100,000.

*E. J. Davis, Northwest Bldg., it is stated, has received the general contract to erect the 3-story and basement 50x90 ft. building for the Electrical Eng. Co., at 21 6th St., N., at $20,000. Wm. M. Kenyon, Guaranty Bldg.

The Knights of Columbus, it is reported, are contemplating the erection of a building at a cost of about $25,000.

Kansas City, Mo.—The Western Grocer Co. will erect a brick store at 809-13 Sante Fe St., to cost $45,000.

St. Joseph, Mo.—The Masons are said to be contemplating the erection of a temple to cost about $100,000.

**St. Louis, Mo.*—Steve Collins, of Rock Island, Ill., it is reported, has received the contract to erect the $150,000 storehouse and office building which is to be erected in this city for Deere & Co., of Moline, Ill.

Farrar & Tate, Wainwright Bldg., it is reported, have prepared plans for a 15-story building, which it is proposed erecting at 14th St. and Washington Ave., at an approximate cost of $1,000,000.

It is reported that the McNichols Furniture Co., Henry J. McNichols, Pres., will erect an 8-story building at 1020 Market St., estimated to cost $200,000.

The Advance Realty Co., it is reported, has been incorporated with a capital of $1,000,000, for the purpose of erecting a business building at Olive St. and B'way. Thos. O. J. McCawley is among the incorporators.

Hastings, Neb.—It is reported that the erection of a Y. M. C. A. building, to cost about $25,000, is under consideration.

Pennington, N. J.—See "Paving and Roadmaking."

Paterson, N. J.—It is reported that the Paterson Theater Co. has been incorporated with a capital of $100,000 for the purpose of erecting a theater and hall at Hamilton and Union Sts., to cost $80,000. Frank Keeney, of the Keeney Theater, Brooklyn, N. Y., is said to be one of the incorporators.

Atlantic City, N. J.—Josiah White & Sons, of the Marlborough House, it is reported, have had plans prepared for a wing to be erected at a cost of about $500,000.

**Long Branch, N. J.*—The contract for erecting Jacob Steinbach's department store at Long Branch has been awarded to White & Coyne, of Long Branch, at about $53,000.

New York, N. Y.—Chas. Seymour & Co., it is stated, have leased the site at B'way and 56th St., and intend erecting a 3-story and basement fireproof garage, to cost $40,000.

Brooklyn, N. Y.—Plans have been filed for a 6-story brick store and apartment building to be erected at Throop Ave. and Wallabout St., at a cost of $60,000. Owner, Ballkeiser & Wexler; 11 Graham Ave.; archt. Saml. Sass, 23 Park Ave.

Jamaica, L. I., N. Y.—The Title Guarantee & Trust Co., of Brooklyn, it is stated, has had plans prepared by Helmle, Huberty & Hudswell, 44 Court St., Brooklyn, for a 3-story stone building which it is proposed erecting on Fulton and Washington Sts., to cost about $60,000.

Rochester, N. Y.—The erection of a temple on the west side for the I. O. O. F., is stated to be under consideration. Probable cost, $25,000. Frank Page, of Temple Lodge, is secy. of the com. having the matter of erection in charge.

Buffalo, N. Y.—It is stated that Peter H. Frank will erect a $30,000 brick building at 273 Richmond Ave.

Binghamton, N. Y.—H. C. Larrabee, Pres. Sturtevant-Larrabee Co., writes that it is proposed to erect a building 50x100 ft. to be used for storage only, and will not use any power in connection with this building.

Cincinnati, O.—Gustave Drach, Union Trust Bldg., it is stated, has been commissioned to prepare plans for a 4-story concrete building which is to be erected at 9th St. and B'way by the Live Oak Distilling Co., at a probable cost of $50,000.

*Nicholson Bros., 315 Dearborn St., Chicago, Ill., it is reported, have received the masonry contract on a $400,000 building which is to be erected here for the Fourth National Bank. permit to erect a 4-story structure of stone, iron and brick at Eighth and St. Clair Sts., adjoining the Salvage Corps house. It is to be used for lodging and offices and will cost $35,000.

Delphos, O.—The Cincinnati, Hamilton & Dayton Ry. (C. A. Wilson, Ch. Engr., Cincinnati), it is stated, intends erecting a depot on the site of the present structure.

Steubenville, O.—It is reported that the Pennsylvania R. R. (W. H. Brown, Ch. Engr., Philadelphia, Pa.), will erect a $40,000 passenger depot here.

Guthrie, Okla. Ter.—Jos. Foucart, of Guthrie, has prepared plans for a 3-story store, 50x140 ft., for C. A. Filtch, to cost $20,000.

**Philadelphia, Pa.*—A permit has been granted to Wm. Steele & Sons, 1600 Arch St., for a 3-story brick dye house to be erected at Boston Ave. and Emerald St., to cost $20,000.

Wilkinsburg, Pa.—The Penwood Club members are said to be contemplating the erection of a new clubhouse at a cost of $20,000.

Bristol, Tenn.—It is reported that the officials of the Norfolk & Western Ry. (C. S. Churchill, Ch. Engr., Roanoke, Va.) are taking steps to make improvements in this city at a cost of $250,000, which will include the extension of the yard tracks, the enlargement of the roundhouse and the erection of new repair shops.

Chattanooga, Tenn.—Trigg, Dobbs & Co. will erect a 5-story, 70x150-ft. building; will not need any new machinery.

Paris, Tex.—The Texas & Pacific Ry. Co. (B. S. Wathen, Ch. Engr., Dallas), it is reported, is seeking a site in this city on which it is proposed to erect a $40,000 brick depot.

**Salt Lake City, Utah.*—The Utah Realty Co., it is reported, has awarded the contract to erect the Herald Bldg., on S. Main St. to McDonald & Son, at $90,000.

Colfax, Wash.—Preusse & Zittel, of Spokane, are preparing plans for a $30,000 commercial building, which is to be erected here by Julius Lippuit.

Tacoma, Wash.—Geo. Bott, it is stated, is having plans prepared by C. A. Darmer, California Blk., for a 3-story building to be erected on

**Milwaukee, Wis.*—W. G. Williams, 179 Wisconsin St., it is reported, has received the contract for improvements to be made to the Merrill Bldg., at $26,000. Van Ryn & De Gelleke, 211 Grand Ave., is the archt.

NEW YORK, N. Y.

22 Beach St., 10-story br and stone warehouse; c, $200,000; o, Merchants Refrigerating Co.; a, Wm. H. Birkmire.

257 W 38th St., 9-story br and stone hotel; c, $135,000; o, Plymouth Realty Co.; a, G. Robinson & Son.

104 W 42d St., 6-story br and stone store and office bldg.; c, $60,000; o, American Radiator Co.; a, Alex. B. Trowbridge.

43d St. and Madison Ave., 3-story br and stone office bldg; c, $200,000; o, N Y C & H R R R Co; a, C A Reed.

B'way and 50th St., 3-story br and stone garage; c, $80,000; o, Wendel Estate; a, Henry C Hollwedel.

105 E 113th St., 3 6-story br and stone stores and tenemts; total c, $120,000; o, Max Weinstein; a, Sam'l Sass.

118th St. and Park Ave., 6-story br and stone store and tenemt; c, $45,000; o, Jos Bornstein; a, Edward A. Meyers.

98th St. and Central Park West, 2 6-story br and stone tenemts; total c, $100,000; o, Chas and Henry Friedman; a, Bernstein & Bernstein.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—T. C. Thompson & Bros., of Birmingham, it is reported, have received the contract to erect an entire block of stone flats, to cost $300,000.

Denver, Colo.—It is reported that a $25,000 flat is to be erected at E. 7th St. and Gaylord Sts., by Murto & Humphreys.

New Haven, Conn.—Brown & Van Beren, Exchange Bldg., it is stated, are preparing plans for a $25,000 residence which is to be erected on Prospect St., for Sam'l A. York.

Washington, D. C.—A building permit has been granted to the Kennedy & Davis Co. to erect a 4-story apartment house at 149 H St. N. W., which is to cost $30,000.

Atlanta, Ga.—The congregation of the Grace M. E. Church, it is stated, is contemplating the erection of a new edifice at a cost of $30,000. A. C. Bruce, Engr., Amer. Bldg., is the archt.

Rockford, Ill.—A Bldg. Com., of which Frank Newberg is a member, has been appointed to secure plans for a new edifice which the congregation of the Swedish Free Church intends erecting at 6th St. and 4th Ave. at a cost of $30,000.

New Orleans, La.—It is reported that Leopold Levy will erect a $50,000 residence on St. Charles St.

New Bedford, Mass.—The Polish Catholics are reported to be considering the erection of a church on N. Front St., and later on a parish house and school. Address Rev. Edw. A. Uminski.

**Wesley, Minn.*—E. H. Moehike, of Mankato, it is reported, has received the contract to erect the edifice for the Holy Trinity Church, at about $18,988.

Minneapolis, Minn.—Jos. F. Malone will erect a 4-story brick flat at 606 7th St. S. E., to cost $30,000.

Fritz Schreyer will erect a 4-story brick apartment house at 714 S. 5th St., to cost $20,000.

Newark, N. J.—It is reported that the Church Extension Com. of the Newark Presbytery will erect a chapel to cost $25,000 at Mt. Prospect and Arlington Aves.

Jamaica, L. I., N. Y.—The members of the Jamaica Presbyterian Church, it is stated, are contemplating the erection of a chapel t $20,000, and in the near future the e of a new edifice to cost about $100,000.

Cleveland, O.—A permit has been gran M. Littwitz for a 4-story apartment ho be erected at Prospect and Hayward Sts., at cost of $25,000.

Ashtabula, O.—Plans have been comple is reported, for a new edifice which is erected for the M. E. Church, at a c $35,000. Rev. C. H. Stocking, pastor.

East Palestine, O.—It is reported th Trus. of the M. E. Church have accepted for a new edifice which it is proposed e at a cost of about $21,000. Address Pa

**Altoona, Pa.*—P. W. Finn, it is state received the contract to erect the First dist Church at $50,000.

**Spokane, Wash.*—J. W. Forrest, it is has received the contract to erect a res for Reuben Weil, at Poplar St. and 2d A $18,000. Albert Held, Hyde Blk., is the

Winnipeg, Man.—Bids are wanted Apr. erecting an apartment house at B'wa Edmonton Sts., John D. Atchison & Co., A 51 Merchants Bank.

New York, N. Y.

65 W 54th St., 4-story br and stone dw $40,000; o, Arkonia Realty Co; a, Isr Harder.

666 5th Ave., 6-story br and stone dw $200,000; o, Mrs. Wm. K. Vanderbilt, McKim, Mead & White.

114th St. and Manhattan Ave., 6-story stone tenemt; c, $60,000; o, Economy Bl Realty Co; a, Geo F Pelham.

121st St. and B'way, 3 6-story br and tenemts; total c, $240,000; o, West Side Co; a, Geo F Pelham.

122d St. and B'way, 6-story br and tenemt; c, $90,000; o, West Side Const a, Geo. F. Pelham.

Amsterdam Ave. and 121st St., 6-story stone tenemt; c, $120,000; o, Fichter & a, Neville & Bagge.

148th St. and Park Ave., 5-story br tene $50,000; o, Maurice Miller; a, Moore & siedel.

158th St. and Melrose Ave., 6-sto tenemt; c, $60,000; o, Henry S. Gam Geo. T. Pelham.

158th St. and Elton Ave., 2 6-story b emts; total c, $80,000; o, Arthur W. a, B & J P Walther.

167th St. and 3d Ave., 2 6-story br te total c, $70,000; o, Hyman & Simon; a stein & Bernstein.

175th St. and Croton Ave., 5-story b emt; c, $50,000; o, Mary E. Halley; a, & Landsiedel.

124th St. and 8th Ave., 6-story br an tract); Uvalde Asphalt Paving Co., (a loft bldg; c, $55,000; o, Chas Weisb a, Henry Andersen.

148th St. and Amsterdam Ave., 6 5-st and stone tenemts; total c, $275,000; o, piro & Samuels; a, Bernstein & Bernst

152d St. and Amsterdam Ave., 2 5-story stone tenemts; total c, $90,000; o, Mc Realty & Constr. Co.; a, John Hauser.

8th Ave. and 153d St., 6-story br and stores and tenemt; c, $45,000; o, Wm. Coh Neville & Bagge.

153d St. and 8th Ave., 3 6-story br and stores and tenemts; total c, $120,000; o, & Cohen; a, Neville & Bagge.

8th Ave. and 153d St., 5-story br and store and tenemt; c, $42,000; o, Alex Can a, J C Cocker.

727 147th St., 6-story br piano facto $50,000; o, Weber Piano Co.; a, Wm. J.

171 E 79th St., 4-story br and stone ext to 3-story br and stone telephone exchang office bldg; c, $65,000; o, New York Tele Co.; a, Eidlitz & McKenzie.

B'way and 39th St., alterations to 3-st and stone theater; c, $50,000; o, estate of M & Robt T Bixby; a, Francis H Kim

SCHOOLS.

Notes Arranged Alphabetically by Stat

Birmingham, Ala.—The Bd. of Educ. h cepted plans prepared by Miller & Martin, Bldg., for a 10-room school to be erect Drennen Park at Five Points, and cost $2 and the plans prepared by D. A. Helmich 21 St., for the Barker school, which is t tain 8 rooms and to be erected at 13th and 23d St., at a cost of $18,500.

Talladega, Ala.—The Bd. of Directors Alabama Synodical College, it is stated, decided to erect next fall a new building college for administrative purposes, at of $50,000. Rev. G. W. Patterson, of gomery, is Chmn. of the Bd.

Montgomery, Ala.—It is stated that A Carnegie has given $10,000 to the State N School for Negroes which is situated nea city, to erect a library.

San Francisco, Cal.—The Bd. of Superv. reported, has authorized the Bd. of Pub. to receive bids for erecting a 5-room ad to the Crocker Grammar School at a co $17,500.

The Washington Grammar School, for bids for the construction are soon to ceived by the Bd. Pub. Wks., is to cost $119,000.

Santa Rosa, Cal.—The citizens have vot Mar. 28 in favor of issuing $235,000 bon be used as follows: $35,000 for school poses; $72,500 for a sewer system; $72,50 a water system, and $50,000 for streets.

**Washington, D. C.*—Richardson & Bu Colorado Bldg., it is stated, have receive contract to erect the McKinley Bldg., a n structure, on the grounds of the American at a cost of about $250,000.

Atlanta, Ga.—The plans submitted by Ha Bleckley, Empire Bldg., have been selecte school to be erected in the 8th Ward, at a of $15,000.

**Items marked thus give the names of parties awarded contracts.*

hicago, Ill.—The Com. on Bldgs. & Grounds the Bd. of Educ., it is reported, has decided eplace the Washington School with a struc- containing 26 rooms and an assembly hall to cost about $175,000.

entralia, Ill.—The citizens have voted in favor the School Bd. issuing $18,000 bonds to pur- se a site and erect an 8-room school.

hicago, Ill.—Pres. Mark, of the Bd. of Educ., s stated, has announced that plans are to be ared at once for a building, which is to in- le the home of the Bd. of Educ. and a com- cial high school, the cost to be about $500,- It is to be erected at Harrison St. and mouth Court.

uincy, Ill.—It is reported that the Bd. of c. is contemplating the erection of 3 schools ch will include a high school and an addition, Franklin school which is to contain 12 ns and the Berrian school which is to con- 8 rooms.

ndianapolis. Ind.—Clarence Martindale, In- a Trust Bldg., it is reported, has submitted he Governor and the Comn. having in charge erection of the new Industrial School for s plans for a building for said purpose for ch the Legislature recently appropriated ,000. John T. Stout, of Paoli, and E. M. pbell, of Indianapolis, are members of the n.

harpsville, Ind.—It is stated that about May he Township Trus. will let the contract to t a high school, 2 stories high, of brick and e. J. F. Alexander, Archt., of Lafayette, , may be able to give further information.

ranklin, Ind.—H. B. Wilson, Supt. of ools, writes that it is proposed to erect a ol here at a probable cost of $45,000. Ar- ects, Shopbell & Harris, Evansville.

wa City, Ia.—Wm. J. McChesney, Sec'y Regents of the State Univ. of Iowa, writes the time for awarding the contract for ting the Engineering Bldg. at the Univ. been extended from Apr. 5 to Apr. 12.

es Moines, Ia.—Andrew Carnegie has given 000 to Drake Univ., to erect a library, on lition that a like sum is raised.

rinnell, Ia.—Brainerd & Russell, of Bos- Mass., it is stated, has prepared plans for apel to be erected at Grinnell College, at st of $30,000. Dr. E. Clark, Trus.

exter, Ia.—It is stated that bids will be ived Apr. 22 for erecting a 2-story and ment, 53x86-ft. brick school. J. J. Ham- d, Clk., Bd. Educ.

ma, Mich.—The proposition to issue $20,000 ol bonds is reported to have carried.

yandotte, Mich.—Edw. A. Van Leyen, Penin- Bk. Bldg., Detroit, and Edw. A. Schilling, ort St. W. Detroit (Assoc.), it is stated, prepared plans for a 2-story and basement and stone high school, 138x80 ft., which be erected at a cost of $50,000.

sston, Minn.—F. D. Orff, 613 Lumber Ex- ge, Minneapolis, it is stated, is preparing for a high school to be erected at a cost 25,000.

Joseph, Mo.—Eckel & Mann, Commercial ., have submitted plans for a 4-room addi- to the McKinley school which is estimated st about $14,000.

illon, Mont.—Frank P. Birrer, of Dillon, secured the contract for erecting an addi- to a school here for $15,022.

gar, Neb.—It is reported that the citizens voted in favor of issuing $20,000 school s.

nchester, N. H.—The City Council is d to have appropriated $42,000 for a school, ding site. C. F. Read, Chmn. Com. on s and Bldgs.

arwood, N. J.—L. L. Loveland, of Ro- it is stated, has received the contract to the boro. school at $12,205.

rence, N. J.—The question of issuing $20,- school bonds is reported to have carried.

w York, N. Y.—Bids will be received Apr. C. B. J. Snyder, Supt. School Bldgs., for eneral construction, etc., of 2 temporary l buildings on the southerly side of Man- approach to the Williamsburg Bridge.

w York, N. Y.—C. B. J. Snyder, Supt. of ., Bd. of Educ., has submitted to the Bldg. plans for the building which is to replace School No. 3, at Grove and Hudson Sts. to be a 5-story fireproof brick and limestone ng and is to cost about $230,000.

oklyn, N. Y.—Bids will be received Apr. C. B. J. Snyder, Supt. School Bldgs., N. ity, for the general construction, etc., of on to School No. 27 and the Teachers' ing School; also for the sanitary work and tting of the Commercial High School, all ooklyn Boro.

gara Falls, N. Y.—A 3-story stone gym- n is to be erected at the Niagara Univ. at t of $50,000.

yville, N. Y.—It is reported bids will be ed Apr. 11 for erecting a 3-story normal . Jos. Carhart, Sec'y, School Bd.

henecady, N. Y.—Jas. C. McDonald, Clk. Contract & Supply, writes that the con- for plumbing, ventilating and heating n Ave. school (bids opened Mar. 29) has awarded to Levi Case & Co., of Schenec- for $10,475.

tertown, N. Y.—The citizens have voted or of erecting a school at a cost of $45,-

ivar, N. Y.—Werdein & Rail, of Dansville, it is stated, have secured the contract to erect the brick high school at $21,478, and Pease & Howard, of Syracuse, the contract for the heating plant in same at $2,246.

**Page, N. D.*—H. E. Allen, of Fargo, it is stated, has received the contract to erect a school at $11,798, and Holt, Dahlby & Riley, of St. Paul, Minn., the contract for heating plants and plumbing of same at $1,834.

Cleveland, O.—The Bldg, Com. of the Bd. of Educ. has decided to recommend the building of an 18-room school in Oakland, at a cost of $65,000.

**Van Wert, O.*—C. C. Clark, Clk. Bd. Educ., writes that the contract for furnishing material and erecting 4th Ward school (bids opened Mar. 27) has been awarded to H. F. Rumps, of Van Wert, for $24,991.

Granville, O.—The Barney Science Hall at Dennison Univ., it is reported, has been destroyed by fire.

West Richfield, O.—N. A. Mantz, of Akron, it is stated, is preparing plans for a high school to be erected here to take the place of the structure which was recently destroyed by fire.

Wilkesbarre, Pa.—The congregation of St. Mary's Church, it is stated, is contemplating the erection of a new parochial school at a cost of about $50,000. Rev. Father McAndrew, pastor. The erection of a 3-story brick school on Courtright Ave. at a cost of about $20,000 is reported under consideration.

Sharpsburg, Pa.—S. A. Hall and B. R. Stevens, of Pittsburg, it is stated, have prepared plans for a 3-story school which is to be erected at Penn Linden and Clay Sts.

Altoona, Pa.—The School Bd. of Logan Township has engaged Shollar & Hersh to prepare plans for two schools, one to be erected in Llyswen and the other in the East End. They are to be 2-story brick structures.

Aberdeen, S. D.—Bids will be received Apr. 25 by the Regents of Educ. (Irwin D. Aldrich, Secy.), care Depot Hotel, Huron, S. D., for erecting a machine shop, including plumbing and heating on the grounds of the Northern Normal and Industrial School here.

North Ft. Worth, Tex.—H. L. Proctor, City Sec'y, writes that the citizens voted Mar. 28 to issue $23,000 bonds for erecting a school.

Panguitch, Utah.—Bids will be received May 2 by F. E. Leupp, Comr. of Indian Affairs, Dept. of Interior, Washington, D. C., for furnishing material and constructing a brick dormitory, water, sewer, pump house and well, etc., at the Southern Utah School. Laura B. Work, Supt.

**Williamsburg, Va.*—Richardson & Son, of Hampton, it is reported, have received the contract to erect the $15,000 science hall at William and Mary College.

**Tacoma, Wash.*—The Ben Olson Co., it is stated, has received the contract for the plumbing in the high school at $10,147 and Chas. A. Richardson the contract for heating system at $24,917. Contractors of Tacoma.

Spokane, Wash.—A parochial school is to be erected for the parish of Our Lady of Lourdes, at a cost of $20,000.

Auburn, Wash.—The citizens have voted in favor of issuing $18,000 bonds to erect a school.

North Yakima, Wash.—The Bd. of Educ., it is reported, has rejected all bids received Mar. 22 for erecting the school, as the bids submitted exceeded the estimated cost which was $20,000. New bids will be received.

Cuba, Wis.—Bids will be received by the School Bd. of Dist. No. 9 (W. J. Kirlahan, Clk.), Apr. 15, for erecting an 8-room, 2-story brick high-chool building. Van Ryn & De Gelleke, Archts., 211 Grand Ave., Milwaukee.

Rhinelander, Wis.—It is reported that the city contemplates erecting a high school this summer to cost about $50,000.

LaCrosse, Wis.—The Bd. of Educ. has decided to have detailed plans prepared at once by Archt. Llewellyn, of St. Louis, Mo., for the high school which is to be erected at a cost of about $100,000.

Eau Claire, Wis.—Chandler & Park, 400 Main St., Racine, it is reported, have been engaged to prepare plans for a high school which is to be erected here at a cost of $25,000.

Dodgeville, Wis.—It is reported that Chandler & Park, 400 Main St., Racine, have been engaged to prepare plans for a school which is to cost $25,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Indianapolis, Ind.*—Local press reports state that contracts for sprinkling the improved streets of the city were awarded by the Bd. of Wks., on Mar. 29, as follows, price given per 10,000 sq. yds.: Sec. 1, Henry Nolting, $16.84; Sec. 2, Chas. Raepke, $18.25; Sec. 3, Fred. Fuerhing, $13.80; Sec. 4 and 5, Kennington Bros., $12.70; and Sec. 6 to Kennington Bros. for $14.60. There are 21,555,120 sq. ft. to be sprinkled.

**Lowell, Mass.*—The Decarie Mfg. Co. of Minneapolis, Minn., is reported to have secured the contract for a garbage crematory for Lowell.

New York, N. Y.—Bids will be received Apr. 13 by John McG. Woodbury, Comr. St. Cleaning, for furnishing and delivering 30 watering or sprinkling trucks, for the Boroughs of Manhattan and Bronx.

Columbus, O.—Bids will be received Apr. 13 by the Bd. Pub. Service (Chas. H. Frank, Sec'y) for furnishing 5 street sweepers, 3 dump carts and 2 street flushers.

Philadelphia, Pa.—Local press reports state that bids will be received May 4 by Peter Costello, Dir. Pub. Wks., for disposing of the city garbage during the year 1906.

**Lancaster, Pa.*—The J. Scott Dickey Co. is reported to have secured the contract for collecting the garbage for the ensuing year for $9,000.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Pinckneyville, Ill., Milling Co. will erect a plant at Kansas City, but details have not yet been decided.

The Black-Clawson Co., Hamilton, O., may remodel its machine shop.

The Brundidge, Ala., Fertilizer Co. writes that it has not yet decided the size of the building it will erect nor details regarding the machinery to be installed.

The Hart-Parr Co., Charles City, Ia., expects to erect 83x170 and 60x84-ft. additions to its plant, to increase the capacity of the foundry and machine shops and to extend work along the line of building traction gasoline engines. The buildings will be fitted with traveling cranes and used principally for erecting work.

The Patchogue, N. Y., Mfg. Co. will at once begin the erection of a 3-story, 170x80-ft. addition to its plant, to be used as an Irish point curtain department.

The New Castle, Pa., Forge & Bolt Co. has issued bonds to the amount of $75,000 to furnish additional working capital and to take care of certain contemplated improvements, details of which are unavailable.

The Union Drawn Steel Co., Beaver Falls, Pa., writes that it is not in position at present to give details regarding plant to be built at Hamilton, Ont.

The Brunswick, Minn., Starch Mfg. Co. is being organized to erect a factory, estimated to cost $8,000. Victor Skoglund is interested.

The Frazer Bros. Co., Adams, N. Y., is negotiating for the purchase of a small foundry equipment.

The Union Hardware & Metal Co., Los Angeles, Cal., is in the market for three or four elevators. Electric power will probably be used.

The Trumbull Electric Mfg. Co., Plainville, Conn., expects to build during the summer a 3-story and basement brick building, about 106x40 ft. The company is in the market for a 75-h.p. high-speed engine, a 50-h.p. boiler and other necessary equipment.

The Monmouth Canning Co., Portland, Me., will erect a 36x108-ft. building, a 2-story, 80x26-ft. building and a 100x24-ft. building. The power plant will include an engine of about 20-h.p. and a 100-h.p. boiler.

The Schaghticoke, N. Y., Powder Co. writes that the buildings lost by the recent explosion at the plant were inexpensive. The largest part of the expense will be to replace the machinery.

The Allis-Chalmers Co. is considering the building of an addition to cost from $300,000 to $500,000 to its West Allis, Wis., plant, according to local press reports.

The Enterprise Box & Lumber Co., Milwaukee, Wis., will build a factory to cost $60,000, according to local press reports. Contracts for mason and carpenter work have been let.

The American Seeding Machine Co., Springfield, O., has taken out a permit to erect a $15,000 brick addition to its plant, according to local press reports.

Adlesdorf & Worsham, Norfolk, Va., will erect a peanut-cleaning factory, according to local press reports. The building will cost about $20,000.

The general machine shop, blacksmith shop and punch shops of the Buffalo, N. Y., Dry Dock Co. have been burned, according to local press reports, with a loss of $75,000 to $100,000.

The H. T. Lawler Milling & Trading Co., New Orleans, La., has been organized with a capital of $100,000 and will erect a flour mill, according to local press reports.

The J. W. Bishop Co., Worcester, Mass., has been awarded a contract for the construction of a $200,000 mill for the Bigelow Carpet Co., in Lowell, according to local press reports. It is stated the building will be seven stories, 225x60 ft.

The West Allis, Wis., Malleable Iron & Chain Belt Co. will erect a 70x220-ft. addition to its foundry, and a 2-story addition to the machine shop, according to local press reports.

The Minneapolis Steel & Machinery Co. has obtained the contract to build the ore bedding plant and reverbatory furnace for the Greene Consolidated Copper Co. at the mines, Cananea, Sonora, Mexico. Between 600 and 700 tons of structural steel will be required. The work is to begin at once.

The greater part of the axle grease factory and oil refinery of Hisgen Bros., Albany, N. Y., has been destroyed by fire. The size of the plant to be erected to replace it has not yet been decided.

The Tulsa, Ind. T., Foundry & Machine Co. will erect a new plant and has purchased a Whiting cupola of 6 to 7 tons capacity.

The Southern Electric & Mfg. Co., Anniston, Ala., will erect a plant, which will include a 96x60-ft. machine shop, 3-story, 24x100-ft. building to be used as storeroom, offices, etc., and an engine and boiler room 24 ft. square. The plant will be equipped with electric motors and a direct-connected dynamo of about 25 h.p. capacity and a large boiler. W. L. Goodhart, secy. and treas.

The McDanell Furniture Mfg. Co., Warsaw, Ky., has been incorporated with a capital of $25,000 and will erect a 3-story, 52x182-ft. factory building, a 34x36-ft. power house and 35x45-ft. dry kilns. The company is in the market for a complete outfit of woodworking machinery, steam plant, heating and ventilating plant, dry kilns, etc. Rod Perry, pres.

The Williamston, S. C., Mills propose erecting a new cotton mill, but plans have not yet matured. Jas. P. Gossett, pres.

The Ettrick Mills, Auburn, Mass., will erect a new 196x250-ft. carpet mill building, according to local press reports. Frost, Briggs & Chamberlain, archts.

A 3-story glove factory, for Eisendrath, Schwab & Co., Chicago, to cost $20,000, will be erected, according to local newspaper reports.

The Des Moines, Ia., Bridge & Iron Works will erect a $35,000 addition to its plant for structural cast iron work, according to local newspaper reports.

The Spaulding Mfg. Co., Grinnell, Ia., which manufactures carriages and spring wagons, will erect a smith shop 78 ft. square and a 3-story, 52x91-ft. shipping room and trim shop addition.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Sacramento, Cal.—See "Paving and Roadmaking."

Coronado, Cal.—The City Trus. are reported to have authorized the City Engr. to prepare plans for the construction of a sea wall and boulevard, to cost $800,000.

New London, Conn.—Bids will be received by Col. Chas. F. Powell, Corps. Engrs., U. S. A., New London, on Apr. 15, for furnishing 750 bbls. of American Portland cement, as advertised in The Engineering Record.

**Hartford, Conn.*—The Hartford Paving & Constr. Co. is reported to have secured from the Connecticut River Bridge and Highway District Com. the contract for filling on the west side, in the bridge causeway construction for about $100,000. The contract was originally awarded in Feb., but the contractors receiving the contract withdrew their bid.

Washington Barracks, D. C.—Bids will be received by Capt. John Stephen Sewell, Corps. Engrs., U. S. A., Apr. 10, for furnishing and erecting at War College here, building boon crane derrick, with tower for supporting same and hoisting engine for operation.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Chicago, Ill.—All bids opened on Mar. 22 by the Bd. of Trus., Sanitary Dist. of Chicago, for $2,000,000 Sanitary Dist. bonds have been rejected. S. D. Griffin, Clk.

Lafayette, Ind.—It is stated that bids will be received until Apr. 15 by Geo. H. Stevenson, Drainage Comr. for constructing the Frank Kirkpatrick Ditch.

Glenwood, Ia.—It is reported that bids will be received Apr. 17 by the Co. Aud. for constructing sections 1 to 9 of the Mills County division and sections 1 to 10 of the Fremont County division of the Mills and Fremont County ditch. The sections contain from 1,000 to 2,000 cu. yds. of excavation each.

**Baltimore, Md.*—N. H. Hutton, Harbor Engr., writes that the Maryland Dredging Co., of Baltimore, has secured the contract for dredging 225,000 cu. yads. (bids opened Apr. 5), at 12¾ to 21 cts. per cu. yd., according to location and place of deposit.

Boston, Mass.—Col. W. S. Stanton, Corps Engrs., U. S. A., writes that the following are the bids opened on Mar. 30 for rock excavation in Boston Harbor, price given per cu. yd. for 16,555 cu. yds.: Daly & Hanan Dredging Co., Ogdensburg N. Y., $18.40; Dunbar & Sullivan Dredging Co., Buffalo, N. Y., $20.87; P. Sanford Ross, Inc., Jersey City, N. J., $18; G. H. Breymann & Bros., Toledo, O., $16.

Nantucket, Mass.—Bids will be received by Lieut.-Col. J. W. Willard, Corps Engrs., U. S. A., Newport, R. I., on May 3, for jetty construction at Nantucket Harbor, as advertised in The Engineering Record.

Windom, Minn.—Bids will be received Apr. 25 by John A. Brown, Co. Aud., for $13,000 bonds for constructing drainage Ditch No. 2 in the Town of Rose Hill.

Glendive, Mont.—See "Water."

Edgewater, N. J.—Bids will be received by Edw. M. Speer, Boro Clk., Apr. 18, for furnishing material and constructing a public pier, as advertised in The Engineering Record.

New York, N. Y.—The following are the bids opened on Mar. 30 by the Dept. of Docks and Ferries for preparing for and building a new pier on E. Fulton St.: Wm. H. Jenks, 129 Pearl St., $38,101; G. B. Spearin, 17 Battery Pl., $36,932; Bernard Rolf, 39 Cortlandt St., $38,783, and Augustin Walsh, 96 Water St., $37,800.

Bids will be received May 10 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for the elevator equipment in the U. S. Custom House here. Cass Gilbert, Archt., 79 Wall St.

Bids will be received Apr. 17 by Dept. Docks and Ferries (Maurice Featherson, Comr.) for furnishing the labor and materials required for preparing for and building a new pier, with appurtenances, at the foot of E. 94th St., also for removing the present pier (old 18) East River, and building a new pier between Maiden Lane and Pine St., to be known as Pier No. 14. Bids will also be received Apr. 18 for furnishing all the labor and material required for dredging about 100,000 cu. yds. in the East and Harlem Rivers.

New York, N. Y.—See "Public Buildings."

**Items marked thus give the names of parties awarded contracts.*

Brooklyn, N. Y.—The Bd. of Estimate is stated to have on Mar. 31 voted to issue $750,000 corporate stock to purify the Gowanus Canal. A 12-ft. tunnel will be dug from East River to head of canal, and by means of a pumping station water will be pumped into the canal to keep it pure.

Bids will be received Apr. 19 by Martin W. Littleton, Boro Pres., for furnishing all the labor and material required for dredging, as follows: Gowanus Canal, engineer's estimate, 15,000 cu. yds., scow meas. Newtown Creek Canal and basin, included within the boundaries of Johnson, Montrose, Morgan and Varick Aves., engineer's estimate, 9,000 cu. yds., scow meas. Newtown Creek Canal, in basin between Meadow and Stagg Sts., near Morgan Ave., engineer's estimate, 4,000 cu. yds., scow meas.

Buffalo, N. Y.—Col. H. M. Adams, Corps Engrs., U. S. A., is reported to have completed plans which have been approved by the Government for the stone superstructure, riprap and excavation at Buffalo Harbor and for a concrete structure for south pier of Buffalo Harbor.

The Aldermanic Finance Com. is reported to have voted on Mar. 30 to give to the Buffalo Dredging Co. the contract for making and installing a metal drain to take the place of the Clark & Skinner Canal, now being filled in; contract price reported to be $69,000.

Ellis Island, N. Y. Harbor, N. Y.—It is stated that bids will be received until Apr. 18 by Robt. Watchorn, Comr. Immigration, for doing certain dredging near Ellis Island.

Cleveland, O.—The following park improvements are reported to have been decided upon: A subway at foot of Broad St. to cost $16,000, of which the railway companies will pay half; a new culvert for Doan Brook, to cost $8,000; and four shelter houses, to cost $20,000.

Separate bids will be received until May 6 by Lieut. Col. Dan. C. Kingman, Corps. Engrs., U. S. A., for filling with large riprap along the lake face, sheathing the harbor face and repairing the short end of the W. Breakwater, at Cleveland Harbor, O., and for constructing the shore end of the W. Breakwater at Fairport Harbor, O.

Dayton, O.—Bids will be received Apr. 25 by the Bd. of Trus., Dayton State Hospital (A. F. Shepherd, M. D., Sec'y), for piping of power plant and tunnel, pipe covering, coal conveying and ash handling machinery.

**Portland, Ore.*—J. W. Sweeney and the Columbia Contract Co., both of Portland, are stated to have secured the contract to furnish stone for the jetty, bids for which were opened Jan. 31. The Columbia Co. will furnish 400,000 tons at $1.10 per ton and Mr. Sweeney will furnish 110,000 tons at $1.02 per ton.

Lancaster, Pa.—The City Council is stated to have passed an ordinance converting the West End reservoir grounds into a park, to be called Buchanan Park.

Philadelphia, Pa.—The State Senate has passed a bill appropriating $375,000 for the deepening of Delaware River channel, on condition that Philadelphia appropriates a like amount.

Scranton, Pa.—The following are the bids received by the Superv. Archt., Treas. Dept., Washington, D. C., for elevator for U. S. Post-Office, at Scranton: Otis Elevator Co., New York, N. Y., $3,650; Marine Engine & Machine Co., New York, N. Y., $4,033.

Newport, R. I.—Bids will be received by Lieut. Col. J. H. Willard, Corps Engr., U. S. A., on May 3, for dredging at Hyannis Harbor, and at Nantucket, Mass., as advertised in The Engineering Record.

Memphis, Tenn.—The St. Francis Levee Bd. is reported to have, on Mar. 25, sold $250,000 levee bonds. Richard B. Barton, Sec'y, 162 Randolph Bldg.

**Waco, Tex.*—The Otis Elevator Co., of New York, N. Y., has secured the contract for elevator in U. S. Post-Office, including safety appliance (bids opened Mar. 25) for $6,245.

Burlington, Vt.—Bids will be received until Apr. 29 by the Pub. Dock Com. for constructing a public dock on the shore of Lake Champlain at Maple St. The work consists of timber cribs or concrete wall, and about 11,500 cu. yds. of rubble filling. J. E. Burke, Mayor.

Parkersburg, W. Va.—Bids will be received by Maj. Geo. A. Zinn, Egr. U. S. A., Wheeling, on May 3, for building Dam No. 18, Ohio River, four miles above Parkersburg, as advertised in The Engineering Record.

Sydney, New South Wales.—Bids will be received by Chas. A. Lee, Minister for Public Works, on Sept. 1, for the manufacture, supply and delivery in New South Wales, of all steel and iron required by the Government for a perid of seven years, as advertised in The Engineering Record.

Freeport, N. S.—It is stated that bids will be received until Apr. 14 by the Dept. Pub. Wks. (Fred Gelinas, secy.), at Ottawa, Ont., for constructing a breakwater here.

Devil's Island, N. S.—It is stated that bids will be received until Apr. 15 by the Dept. Pub. Wks., Ottawa, Ont. (Fred Gelinas, Secy.), for constructing a breakwater here.

Quebec, Que.—It is stated that bids will be received by J. Gallagher, Water Wks. Engr., until Apr. 13, for supplying lead pipe, pig lead, iron and brass castings, cement, brick and drain pipe.

Ottawa, Ont.—It is stated that bids will be ceived until Apr. 11 by Stephen O'Brien, Secy., Ottawa Improvement Comn. for supplying cement, timber, etc., during the current year.

Panama.—Bids will be received by the Isthmian Canal Commission, at Washington, D. C., on May 3, for steam shovels, as advertised in The Engineering Record.

The Panama Canal Com. is reported to have authorized the construction of marine barracks at Ancon, Panama, at a cost of $65,000.

*The Panama Canal Com. is reported to have contracted with the Ingersoll-Sergeant Drill Co., of New York, for 50 standard rock drills, complete with mountings and equipments, to be used on the great Culebra cut. It also authorized same company to remodel a large number of the drills remaining from the operations of the French company.

PROPOSALS OPEN

For Proposals see pages 52, 56, 57, 58 and 59

WATER WORKS.

Bids Close.		See Eng. Record.
Apr. 10.	Main supply canal, Belle Fourche, S. D. Adv. Feb. 18 to Mar. 25.	Feb. 18
Apr. 10.	Pipe & Spcls., Winnipeg, Man. Adv. Feb. 18 to Mar. 11.	Feb. 18
Apr. 11.	Engine, Elyria, O. Adv. Mar. 25 to Apr. 8.	Mar. 25
Apr. 12.	Portage L. Prairie, Man.	Mar. 11
Apr. 12.	Pipe line, etc., St. John, N.B. Adv. Mar. 25 to Apr. 8.	Mar. 25
Apr. 12.	Pumping plant, Humboldt, Kan.	Apr. 1
Apr. 12.	Locks, etc., Brooklyn, N. Y.	Apr. 1
Apr. 12.	Graham, N. C. Adv. Apr. 1, 8.	Apr. 1
Apr. 12.	C. I. pipe, Portland, Ore.	Apr. 1
Apr. 12.	Hydrants, North Hempstead, N. Y.	Apr. 8
Apr. 15.	Alma, Neb.	Mar. 11
Apr. 15.	Cookeville, Tenn.	Mar. 25
Apr. 15.	Connellsville, Pa.	Mar. 25
Apr. 15.	System, Connellsville, Pa.	Apr. 1
Apr. 15.	Well, Fernandina, Fla.	Apr. 1
Apr. 15.	Irrig. Work, Quanah, Tex.	Apr. 8
Apr. 15.	Pipe, etc., Seattle, Wash.	Apr. 8
Apr. 15.	Wtr. Wks., Northome, Minn.	Apr. 8
Apr. 15.	Pipe, etc., Oswego, N. Y. Adv. Apr. 8.	Apr. 8
Apr. 17.	Pipe line, etc., Augusta, Me. Adv. Apr. 1, 8.	Apr. 1
Apr. 17.	Pipe, Michigan City, Ind.	Apr. 8
Apr. 18.	Pumping engine, Toronto, Ont., Adv. Mar. 11, 18	Mar. 18
Apr. 18.	New Orleans, La. Adv. Feb. 11 to Apr. 8.	Feb. 11
Apr. 18.	Supplies, Wash., D. C.	Apr. 8
Apr. 20.	Pipe, etc., Millville, Minn.	Apr. 8
Apr. 20.	System, Hoisington, Kan.	Apr. 8
Apr. 20.	Main, Wilton, N. H.	Apr. 8
Apr. 25.	Canal, pipe, etc., N. Orleans, La., Adv. Feb. 18 to Apr. 8.	Feb. 18
Apr. 25.	Well, Lower Brule, S. D.	Apr. 8
May 1.	Shirley, Ind.	Feb. 11
May 2.	Pump'g plant, Downey, Cal.,	Apr. 8
May 2.	Well, etc., Panguitch, Utah,	Apr. 8
May 2.	Pipe laying, Cincinnati, O.	Apr. 8
May 5.	Pipe, etc., West Point, N. Y. Adv. Apr. 8.	Apr. 8
May 11.	Pipe, New Orleans, La.	Mar. 25
May 14.	System, Mansfield, La. Adv. Mar. 4, 11.	Mar. 4
May 15.	Engine, etc., Montreal, Que. Adv. Mar. 11.	Mar. 11
May 16.	Irrig. work, North Platte, Neb. Adv. Mar. 25 to Apr. 8.	Mar. 25
Jun. —.	Prescott, Wash.	Apr. 1
June 1.	Canal, etc., Glendive, Mont., Adv. Apr. 8.	Apr. 8

SEWERAGE AND SEWAGE DISPOSAL.

Apr. 11.	Cleveland, O.	Apr. 1
Apr. 11.	South Bend, Ind.	Apr. 8
Apr. 11.	Sioux City, Ia.	Apr. 8
Apr. 12.	Portage Le Prairie, Man.	Mar. 11
Apr. 14.	Blackwell, Okla. Ter.	Apr. 1
Apr. 15.	Puyallup, Wash.	Mar. 25
Apr. 15.	Roanoke, Va.	Apr. 8
Apr. 15.	Washington, D. C.	Apr. 8
Apr. 15.	Barberton, O.	Apr. 8
Apr. 17.	Norristown, Pa.	Apr. 8
Apr. 18.	New Orleans, La. Adv. Feb. 18 to Apr. 8.	Feb. 18
Apr. 19.	Winchester, Ind	Apr. 8
Apr. 20.	Wilton, N. H.	Apr. 8
Apr. 20.	Salem, Mass., Adv. Apr. 8.	Apr. 8
Apr. 24.	Muskogee, Ind. Ter.	Apr. 8
May 1.	Lexington, Ky.	Apr. 1
May 2.	Panguitch, Utah	Apr. 8
May —	New Britain, Conn.	Apr. 8

BRIDGES.

Apr. 10.	New Haven, Conn. Adv. April 1.	Apr. 1
Apr. 11.	New York, N. Y.	Apr. 1
Apr. 11.	Sioux City, Ia.	Apr. 8
Apr. 11.	Marion, Minn.	Apr. 8
Apr. 12.	Cleveland, O.	Mar. 25
Apr. 12.	Waseca, Minn.	Apr. 8
Apr. 13.	Jackson, O.	Mar. 25
Apr. 14.	St. Louis, Mo.	Apr. 8
Apr. 15.	Spokane, Wash.	Apr. 8
Apr. 15.	Birmingham, Ala.	Apr. 1
Apr. 19.	Moscow, Idaho	Mar. 11
Apr. 19.	Cleveland, O.	Apr. 1
Apr. 21.	Cincinnati, O.	Mar. 25
Apr. 21.	Tacoma, Wash.	Apr. 8
Apr. 25.	Cleveland Heights, O.	Apr. 1
Apr. 25.	Indianapolis, Ind.	Apr. 8
Apr. 26.	Denver, Colo. Adv. Apr. 1, 8	Apr. 1
Apr. 29.	Cleveland, O.	Apr. 8
May 1.	Richland, Ark.	Mar. 11
May 1.	Washington, D. C. Adv. Apr. 8.	Apr. 8
May 3.	Peru, Ind.	Apr. 8
May 3.	Wabash, Ind.	Apr. 8
May 5.	Lockland, O.	Apr. 8

PAVING AND ROADMAKING.

Apr. 10.	Menominee, Mich. Adv. Mar. 18 to Apr. 1.	Mar. 18
Apr. 10.	Ft. Schuyler, N. Y.	Mar. 25
Apr. 10.	Braddock, Pa.	Mar. 25
Apr. 10.	Ft. Sheridan, Ill.	Apr. 8
Apr. 11.	New Brighton, S. I., N. Y.	Apr. 1
Apr. 11.	Cedar Rapids, Ia.	Apr. 8
Apr. 12.	Brooklyn, N. Y.	Apr. 1
Apr. 12.	Columbus, O.	Apr. 8
Apr. 12.	Baltimore, Md.	Apr. 8
Apr. 14.	Minneapolis, Minn.	Mar. 25
Apr. 14.	Cincinnati, O.	Mar. 25
Apr. 14.	Janesville, Wis.	Apr. 1
Apr. 14.	West Boylston, Mass. Adv. Apr. 8.	Apr. 8
Apr. 14.	Paris, Ill.	Apr. 8
Apr. 15.	Sullivan, Ind.	Mar. 25
Apr. 15.	Cookeville, Tenn.	Mar. 25
Apr. 15.	East Cleveland, O.	Apr. 1
Apr. 15.	Barberton, O., Adv. Apr. 8.	Apr. 8
Apr. 16.	Reading, Pa.	Apr. 8
Apr. 17.	Cincinnati, O.	Mar. 25
Apr. 17.	Rensselaer, Ind.	Apr. 1
Apr. 17.	Montgomery, Ala.	Apr. 1
Apr. 17.	Perrysburg, O.	Apr. 1
Apr. 17.	New York, N. Y.	Apr. 8
Apr. 17.	Greensboro, N. C. Adv. Apr. 8.	Apr. 8
Apr. 17.	Norristown, Pa.	Apr. 8
Apr. 18.	Mankato, Minn. Adv. Apr. 1, 8.	Apr. 1
Apr. 18.	La Crosse, Wis.	Feb. 25
Apr. 18.	Red Oak, Ia.	Apr. 8
Apr. 18.	Escanaba, Mich., Adv. Apr. 8.	Apr. 8
Apr. 20.	Gettysburg, Pa.	Apr. 1
Apr. 21.	Cincinnati, O.	Mar. 25
Apr. 21.	Traverse City, Mich. Adv. Apr. 8.	Apr. 8
Apr. 24.	Cincinnati, O.	Apr. 1
Apr. 24.	Bowling Green, O.	Apr. 8
Apr. 24.	Wellsboro, O.	Apr. 8
Apr. 24.	Pittsburg, Pa.	Apr. 8
Apr. 26.	Cincinnati, O.	Apr. 8
Apr. 26.	Hoboken, N. J.	Apr. 8
Apr. 30.	Vicksburg, Miss.	Mar. 25
May 1.	Parkridge, Ill.	Mar. 11
May 1.	Evansville, Ind.	Apr. 1
May 2.	Bloomfield, Ind.	Apr. 8
——	Belair, Md.	Apr. 8

POWER, GAS AND ELECTRICITY.

Apr. 11.	Shreveport, La.	Feb. 18
Apr. 11.	Washington, D. C.	Mar. 25
Apr. 11.	Ft. Caswell, N. C. Adv. Apr. 1, 8.	Apr. 1
Apr. 11.	Milwaukee, Wis.	Apr. 8
Apr. 12.	Lockport, Ill. Adv. Feb. 18.	Feb. 18
Apr. 12.	Graham, N. C. Adv. Apr. 1, 8.	Apr. 1
Apr. 12.	Bristol, Conn.	Apr. 1
Apr. 12.	Washington, D. C.	Apr. 8
Apr. 12.	Ft. Warren, Mass.	Apr. 8
Apr. 15.	Alma, Neb.	Mar. 11
Apr. 15.	Cookeville, Tenn.	Mar 25
Apr. 15.	Harrisburg, Ark.	Mar. 18
Apr. 18.	Washington, D. C.	Apr. 8
Apr. 20.	Lindsborg, Kan.	Apr. 8
Apr. 24.	Janesville, Wis.	Apr. 1
Apr. 25.	Washington, D. C.	Apr. 1
Apr. 27.	Ligonier, Ind. Adv. Mar. 25 to Apr. 8.	Mar. 25
Apr. —.	Ft. Valley, Ga.	Jan. 21
May 1.	Empire, Colo.	Mar. 18
May 1.	Shirley, Ind.	Feb. 11
May 2.	Modesto, Cal.	Mar. 25
May 2.	Ft. Ontario, N. Y. Adv. Apr. 8.	Apr. 8
May 3.	Washington, D. C.	Apr. 8
May 10.	Lyons, Kan.	Apr. 8
May 15.	Jewell City, Kan.	Mar. 18
May —.	Meridian, Miss.	Mar. 25
Jun. 3.	Cape Charles, Va.	Apr. 8

BUILDINGS.

Apr. 10.	School, Ithaca, N. Y. Adv. Mar. 4 to 18.	Mar. 4
Apr. 10.	School, New York, N. Y.	Apr. 1
Apr. 10.	School, Corona, L. I., N. Y.	Apr. 1
Apr. 10.	Warehouse, Philadelphia, Pa.	Apr. 1
Apr. 10.	School, Jamaica, L. I., N. Y.	Apr. 1
Apr. 10.	School, Bridgeport, Conn.	Apr. 1
Apr. 10.	School, Buffalo, N. Y.	Apr. 1
Apr. 11.	Pub. Bldg., Washington, D. C. Adv. Mar. 25 to Apr. 1.	Mar. 25
Apr. 11.	Fire engine, New Haven, Conn.	Apr. 1
Apr. 11.	School, Youngstown, O.	Apr. 1
Apr. 11.	School, Malville, N. Y.	Apr. 8
Apr. 11.	School, Mayville, N. Y.	Apr. 8
Apr. 12.	Jail, Oakland, Md.	Mar. 18
Apr. 12.	Court House, Marion, Va.	Mar. 18
Apr. 12.	Hotel, Shenandoah, Pa. Adv. Apr. 1, 8.	Apr. 1
Apr. 12.	Capitol, Columbia, S. C.	Apr. 1
Apr. 12.	School, Buffalo, N. Y.	Apr. 1
Apr. 12.	Hospital, Poughkeepsie, N.Y. Adv., Apr. 1, 8.	Apr. 1
Apr. 12.	Pub. Bldgs., Ft. Lincoln, N. D.,	Apr. 8
Apr. 12.	Univ. Bldg., Iowa City, Ia.	Apr. 8
Apr. 12.	Hospital, Poughkeepsie, N.Y.	Apr. 1
Apr. 13.	Court House, Douglas, Wyo.	Mar. 25
Apr. 14.	School, Petersburg, W. Va.	Apr. 1
Apr. 15.	Court House, Corsicana, Tex.	Mar. 18
Apr. 15.	Court House, Grundy, Va.	Feb. 18
Apr. 15.	Church, Trenton, Ky.	Mar. 25
Apr. 15.	School, Buffalo, N. Y.	Apr. 1
Apr. 15.	School, Cuba, Wis.	Apr. 8
Apr. 15.	Bus. Bldgs., Rockwell City, Ia.	Apr. 8
Apr. 15.	Y.W.C.A. Bldg., Clinton, Ia.	Apr. 8
Apr. 17.	School, Richmond, Va.	Mar. 11
Apr. 17.	School, Harrison, N. J.	Apr. 1
Apr. 17.	Schools, Brooklyn, N. Y.	Apr. 8
Apr. 17.	School, New York, N. Y.	Apr. 8
Apr. 17.	Court House, Prattville, Ala.	Apr. 8
Apr. 18.	Pub. Bldg., St. Joseph, Mo.	Mar. 18
Apr. 18.	Library, Cincinnati, O.	Mar. 25
Apr. 18.	Boro Hall, New Brighton, S. I., N. Y.	Apr. 8
Apr. 19.	Boilers in Reform, Mansfield, O.	Apr. 1
Apr. 19.	Htg. Pub. Bldg., Ft. Slocum, N. Y.	Apr. 8
Apr. 19.	Boilers in Reform'y, Mansfield, O.	Apr. 1
Apr. 20.	Officers' quarters, etc., West Point, N. Y. Adv. Mar. 25 to Apr. 8.	Mar. 25
Apr. 20.	Pub. Bldg., Ft. Strong, Mass,	Apr. 8
Apr. 20.	Court House, Norman, Okla. Ter.	Apr. 8
Apr. 22.	Storehouse, Ft. Missoula, Mont.	Apr. 1
Apr. 22.	Pub. Bldg., Charleston, S. C.	Apr. 1
Apr. 22.	School, Dexter, Ia.	Apr. 8
Apr. 24.	School, New York, N. Y.	Apr. 1
Apr. 24.	Infirmary, Steubenville, O.	Apr. 1
Apr. 24.	Pub. Bldgs., Ft. Andrews, Peddocks Island, Mass.	Ap
Apr. 24.	Htg. P. O. Bldg., Charlottesville, Va., Adv. Apr. 1, 8.	A
Apr. 24.	Court House, St. Joseph, La.	A
Apr. 25.	Htg. P. O. Bldg., Pierre, S.D.	Ap
Apr. 25.	Post Bldgs., Ft McPherson, Ga., Adv. Apr. 1, 8	Ap
Apr. 25.	School, Aberdeen, S. D.	Ap
Apr. 26.	School, McMechen, W. Va.	A
Apr. 27.	P. O. Bldg., Flint, Mich.	A
Apr. 27.	Pub. Bldgs., Lima, O.	Ap
Apr. 28.	Post Bldgs., Ft. Moultrie, Ga., Adv. Apr. 1, 8	Ap
Apr. 28.	Court House, Wynne, Ark.	A
Apr. 29.	Htg. Pub. Bldg., Washington Barracks, D. C. Adv. Apr. 1 to 8.	Ap
Apr. 29.	Pub. Bldgs., Boston, Mass.	A
Apr. 30.	Bank, Buffalo, N. Y.	A
Apr. —.	School, New Haven, Conn.	M
Apr. —.	Asylum, Jamestown, N. D.	M
May 1.	College plans, Washington, D. C.	M
May 1.	Remov. Pub. Bldgs., Sulphur, Ind. Ter.	Ap
May 1.	P. O. Bldg., Jacksonville, Ill., Adv. Apr. 1, 8.	A
May 1.	School, Sharpsville, Ind.	A
May 1.	Pub. bldg. plans, Jefferson City, Mo., Adv. Apr. 8.	Ap
May 2.	School, Panguitch, Utah	A
May 2.	Hospital, St. Louis, Mo.	A
May 3.	Court House, Vinton, Ia.	A
May 6.	P. O. Bldg., Florence, S. C.	A
May 8.	Interior finish, U. S. Custom House, New York, N. Y., Adv. Mar. 11, 18	M
May 9.	Mech. Equip. U. S. Custom House, New York, N. Y., Adv. Mar. 11, 18	M
May 11.	P. O. Bldg., Laramie, Wyo.	A
May 15.	School, Port Arthur, Tex.	Ap
Jun. 15.	Court House plans, New Orleans, La.	F

MISCELLANEOUS.

Apr. 10.	Derrick, Washington Barracks, D. C.	A
Apr. 11.	Supplies, Washington, D. C.	M
Apr. 11.	Foundry equipment, Philadelphia, Pa.	M
Apr. 11.	Supplies, Washington, D. C.	Ap
Apr. 11.	Cement, etc., Ottawa, Ont.	A
Apr. 12.	Pier, New York, N. Y.	A
Apr. 13.	Cement, Panama	M
Apr. 13.	Riprap, New York, N. Y.	A
Apr. 13.	Street sweepers, etc., Columbus, O.	Ap
Apr. 13.	Lead pipe, etc., Quebec, Que.	A
Apr. 13.	Watering trucks, New York, N. Y.	A
Apr. 14.	Cement, stone, etc., Ft. Revere, Mass. Adv. Mar. 18 to Apr. 8.	M
Apr. 14.	Breakwater, Freeport, N. S.	A
Apr. 15.	R. R. work, Norfolk, Va. Adv. Mar. 18 to Apr. 8.	M
Apr. 15.	Electric crane, Bremerton, Wash.	M
Apr. 15.	Crushing stone, Washington, D. C., Adv. Mar. 25	M
Apr. 15.	Cement, New London, Conn. Adv. Apr. 8.	A
Apr. 15.	Breakwater, Devil Island, N. S.	Ap
Apr. 15.	Ditch, Lafayette, Ind.	Ap
Apr. 17.	Dam No. 2, Pittsburg, Pa. Adv. Mar. 18 to Apr. 8.	M
Apr. 17.	Dam No. 3, Pittsburg, Pa. Adv. Mar. 18 to Apr. 8.	M
Apr. 17.	Dredging Coney Island, N. Y., Harbor, Adv. Apr. 1, 8	Ap
Apr. 17.	Boardwalk, Atlantic City, N. J. Adv. April 1.	A
Apr. 17.	Piers, New York, N. Y.	Ap
Apr. 17.	Ditch, Glenwood, Ia.	A
Apr. 18.	Dredging, New York, N. Y.	Ap
Apr. 18.	R. R. Tunnel, New York, N. Y., Adv. Apr. 1, 8.	A
Apr. 18.	Dam No. 5, Pittsburg, Pa. Adv. Mar. 25 to Apr. 8.	M
Apr. 18.	Levee work, Point a la Hache, La.	M
Apr. 18.	Supplies, Wash., D. C.	A
Apr. 18.	Pier, Edgewater, N. J. Adv. Apr. 8.	A
Apr. 18.	Dredging, Ellis Island, N. Y. Harbor	A
Apr. 19.	Dam No. 4, Pittsburg, Pa. Adv. Mar. 25 to Apr. 8.	M
Apr. 19.	Dam, San Francisco, Cal. Adv. Mar. 25 to Apr. 8.	M
Apr. 19.	Supplies, Panama	M
Apr. 19.	Dredging, Brooklyn, N. Y.	A
Apr. 24.	Garb. Crematory, Los Angeles, Cal.	Ap
Apr. 25.	Dredging, New Orleans, La.	M
Apr. 25.	Ditch, Windom, Minn.	A
Apr. 25.	Pipe covering, Dayton, O.	A
Apr. 27,	Trap Rock, Holyoke, Mass.	Ap
Apr. 29.	Coal handling plant, New Orleans, La.	M
Apr. 29.	Dock, Burlington, Vt.	A
May 1.	R. R. work, Toronto, Ont.	Ap
May 1.	Machinery, Panama, Adv. Apr. 1, 8	A
May 2.	Tools, etc., Panama Adv. Apr. 1, 8.	A
May 2.	Garb. Disp., Philadelphia, Pa.	A
May 3.	Steam shovels, Panama Adv. Apr. 1, 8.	A
May 3.	Dredging, Newport, R. I. Adv., Apr. 1, 8.	A
May 3.	Dam, Parkersburg, W. Va., Adv. Apr. 8.	A
May 3.	Jetty construction, Nantucket, Mass. Adv. Apr. 8.	A
May 6.	Quay Wall, Bremerton, Wash.	M
May 6.	Breakwater work, Cleveland, O.	A
——	R. R. Work, Corry, Pa.	A
May 10.	Ditch, Stevens Point, Wis.	F
May 10.	Elevator, New York, N. Y.	A
Sept. 1.	Steel and iron, Sydney, N. S. W. Adv. Apr. 8.	A

**Items marked thus give the names of parties awarded contracts.*